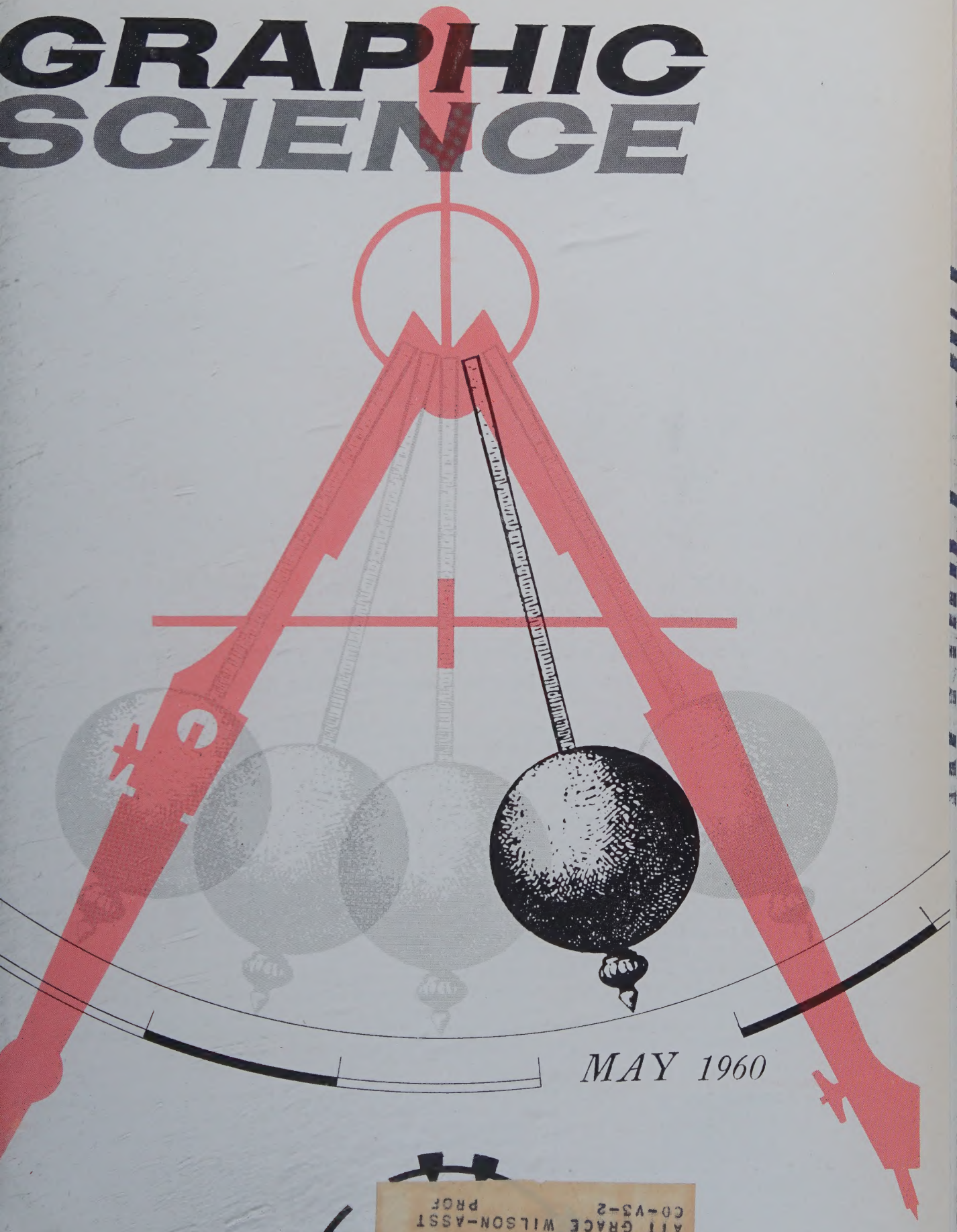
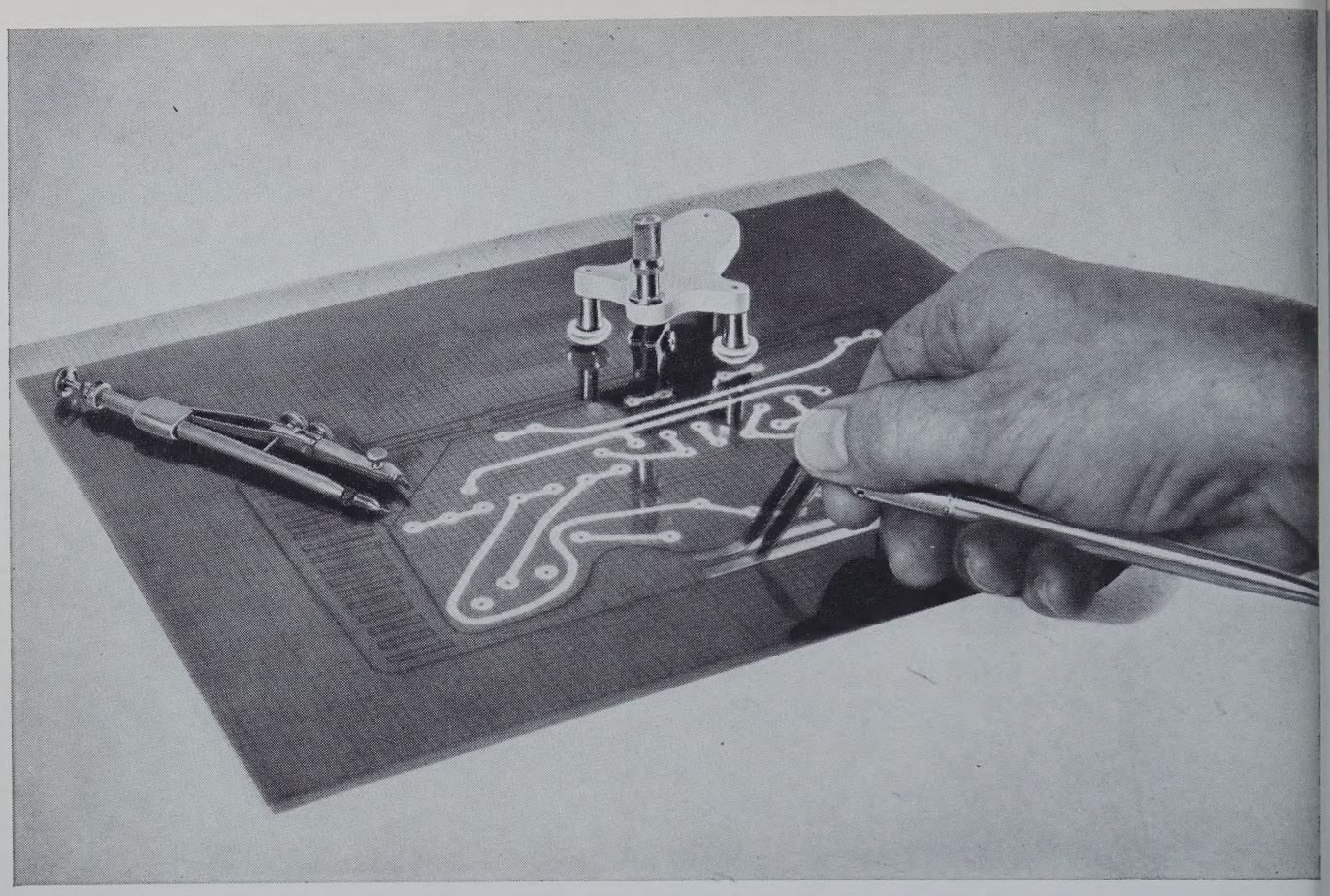
GRAPHIC SCIENCE



MAY 1960



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GRAPHIC SCIENCE

THIS ISSUE: 11,500 COPIES

MAY 1960

VOLUME 2 NUMBER 5

The Magazine of engineering drawing management, covering drafting, reproduction and microfilming, technical illustration, drawing standards and drawing filing in all industries.

ARTICLES

DEPARTMENTS

APHIC SCIENCE is published monthly by nelow Publishing Company, Inc., 103 Park enue, New York 17, N. Y. (MUrray Hill 5-1745). arles E. Rhine, president; Paul Yake, vice sident; David Z. Orlow, secretary-treasurer. APHIC SCIENCE is published (printed) at 116 Main St., Norwalk, Conn. Address changes, undeliverable copies, and orders for subscriptions should be sent to Editorial Offices, 103 Park Avenue, New York 17, N. Y.
Postmaster: Form 3579 requested.
Subscription rates: $8.00 per year in the United States; $9.00 per year to Canada; $10.00 per year to other countries. Single copies: $1.00.

Accepted as controlled circulation publication at Norwalk, Conn. The name "GRAPHIC SCIENCE" is Registered, U.S. Patent Office.

Letters

Simplified Drafting: Con

Sirs:

I'm "agin" it. Simplified drafting, that is. The way I see it, the strongest point made about simplified drafting is the element of time savings. But savings to whom?

Granted you can train a bunch of draftsmen to leave many lines off a drawing, leave off arrowheads, and even free-hand the whole thing; but if the men in the shop resort to jangling the phone off your desk trying to find out what was meant, then where are your savings?

Someone will have to educate the shop and that costs money. Drawings sent to customers may be misinterpreted, and those of us whose drawings must conform to Military Standards can find little evidence that "Uncle Sam" is "sold" on the idea.

Let's leave simplified drafting to threads and repetitious items like holes or springs. It may take a little extra effort on the draftsman's part, but by golly, there's no question about what is shown on a drawing by the correct conventional method.

Lots of success to a fine magazine.

James C. Morrison
Mechanical Designer
North Electric Company
Galion, Ohio

Heat Developing Films

Sirs:

We have been fortunate indeed to have received a free subscription to your new periodical Graphic Science. This magazine is a wonderful piece of work and we were especially impressed with the February issue which contained a writeup on "Heat Developing Films."

Since the articles in your magazine are of interest to such a large volume of persons here at Chrysler Missile we find it difficult to keep tabs on the one copy which we would like to retain in our files. Could you possibly send us two additional free subscriptions? We feel that if these additional subscriptions were circulated around the departments they would stimulate a still greater interest among our personnel.

Any assistance you can render in obtaining the additional subscriptions is sincerely appreciated.

P. R. McVicker
Manager Engineering Records and
Reproduction Department
Chrysler Corporation, Missile Division
Detroit, Michigan

Editor's Note: Additional Subscription Questionnaires were forwarded. Free subscriptions are offered to all qualified personnel; write for additional Questionnaires if you also need them.

Double Reverse

Sirs:

Shame on you! The cover of the March issue showed an original and a copy being peeled apart. One is the reverse of the other in all respects save one—"80 Diam" is correct reading on both.

Thank you for an otherwise fine magazine.

E. S. Blaskey
Chicago 41, Illinois

Blueprint Reading Course

Sirs:

In the February issue of Graphic Science I noticed that Mr. R. S. Wallace of Gillett & Eaton, Inc., of Lake City, Minn., asked for information regarding a blueprint reading course as part of the shop training program, so that he would be able to evaluate it.

For the last three years the Fuller Company has been operating its own technical school. One of the subjects taught the shop personnel, in particular, is a blueprint reading course. I am attaching our Lesson Plan and Instructor's Guide on this course. If you think well enough of our ideas and would care to pass these on to Mr. Wallace, please feel free to do so.

Your magazine goes a long way in giving the draftsman new ideas and suggestions for improvement in operating an Engineering Department.

H. A. Markle, Jr.
Chief Engineer
Fuller Company
Catasauqua, Pa.

Editor's Note: The Fuller Company's Course was forwarded.

Sirs:

We are sending you our 1958-59 Correspondence Bulletin so that you will be able to notice what courses we offer that would be of interest to you. We have written to Mr. R. S. Wallace concerning our courses in Drawing.

Allen E. Wierman
Assistant Supervisor
Correspondence Instruction
The Pennsylvania State University
University Park, Pa.

Sirs:

The February issue of Graphic Science has just been received. This issue as usual, is greeted with anticipation by all members of the Drafting Department here at Olin Mathieson.

The article "Recruiting and Training Draftsmen" was indeed worthwhile, as recruiting draftsmen is becoming increasingly difficult at plants outside the metropolitan areas.

Mr. R. S. Wallace's letter in the February issue asked for information on books for a course in "Blueprint Reading." I am now nearing completion of a course I have been teaching to shop personnel. The text I have been using, and find one of the best available, is titled *Basic Blueprint Reading and Sketching* by C. Thomas Olivo and Albert J. Payne and published by Delmar Publishers, Incorporated, Albany, New York. This text is on a level which the average shop man can understand and follow without a lot of outside study and preparation. I would like to suggest a short

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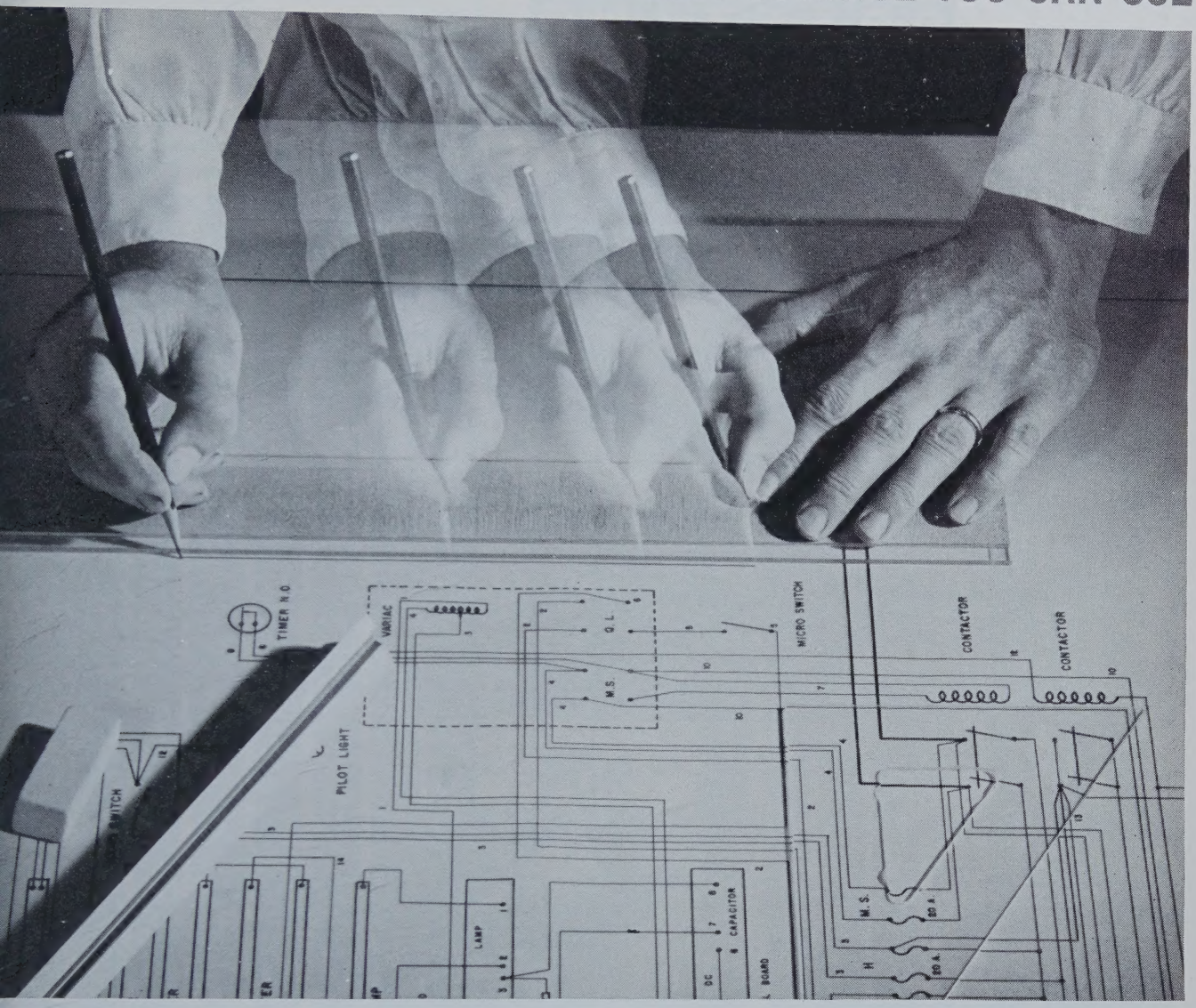

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Letters

course in "Shop Math" before the start of the "Blueprint Reading" course. I have found that many of the shop employees have not found it necessary to use their knowledge of math for several years, and have become a bit rusty.

Your magazine has answered a need for a publication of its kind that has been felt for many years. Now maybe the draftsmen can begin to take their true place in industry. We will be looking forward to many more articles and information specifically aimed at the draftsmen.

JOSEPH D. HENDERSON
Drafting Department Supervisor
Olin Mathieson Chemical Corporation
Hannibal, Ohio

Sirs:

In reply to the request of Mr. R. A. Wallace for textbooks on Shop Blue-Print Reading, we here at the Jersey City Technical Institute have had great success with a book called *Machine Trades Blue Print Reading* by Ihne and Streeter, published by The American Technical Society, Chicago, Illinois.

This book is set up with tear-out problems and achievement tests; also there is available for the instructor a key to the question sheets.

One other book I would recommend is *The Blueprint Language* by Spencer & Grant, published by Macmillan Co., New York. However, it is quite advanced.

WALTER W. GREENHALGH
Instructor Engineering Drawing
Jersey City Technical Institute
Jersey City 6, N. J.

Dimensioning & A Query

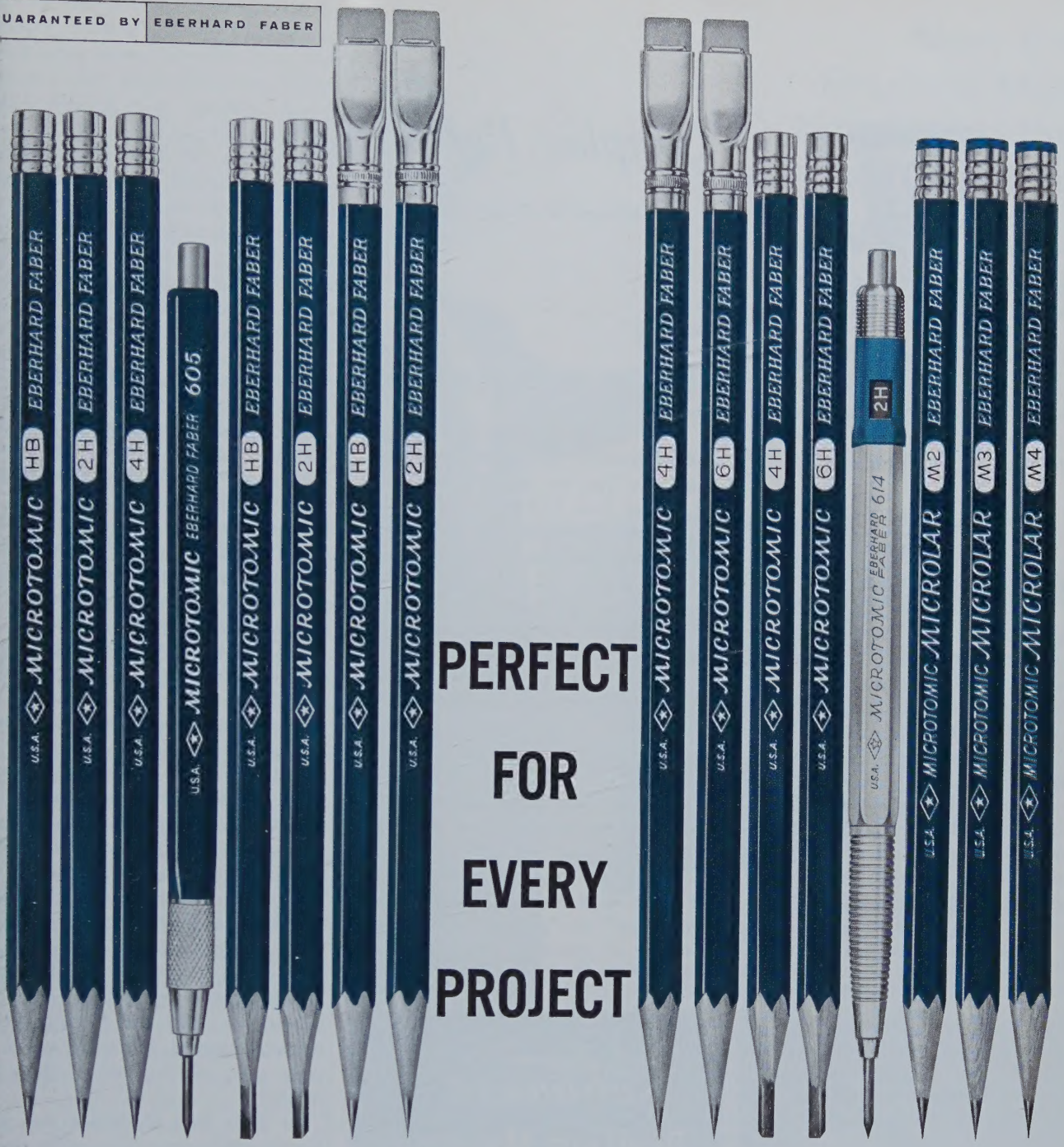
Sirs:

The article by Mr. Bergen on page 34 of GRAPHIC SCIENCE for February, 1960 is very good. More should be written about dimensioning from the standpoint of cost in manufacturing.

In the third paragraph, should not your number (0.005 - inch) be (0.0005) which is one half of 0.001"?

O. A. OLSON
The O. A. Olson Manufacturing Co.
712 Tenth St.
Ames, Iowa

Editor's Note: Yes.



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Graphic Perspective

by Eleanor W. Thompson

Editor's Note: We continue our series of guest-written "Perspectives" with more of Frederic G. Higbee's article, begun in the April issue.

by Frederic G. Higbee

ONE MIGHT ALMOST be permitted to call this period between 1890 and 1900, the "humorous" or even "literary" period in the development of graphic language because of the pages and pages of words which were published in all seriousness about matters which now seem so unimportant. It must be recalled, however, that at this time the "college-trained" draftsman was making his first bow in the industrial world, and that he was being received by his hard-boiled "shop-trained" contemporaries with snorts of derision and a contempt born of a vague alarm that here indeed might be a new menace.

Be it also remembered that these college-trained draftsmen were far from the type we are now so proud of. These men had been trained to make drawings wonderful in appearance, they could shrink paper on the board, they could use water color and India ink wash, but when it came to making a drawing which described the shape and size of an object informing the workman simply and directly what he needed to know about finish, material, and other pertinent items, they could not be compared with that class of veterans who had earned their places in the drawing rooms by virtue of sheer merit and long experience.

Remember, too, that the textbooks of those days were written by "college men" or "professors" and no amount of quotation marks in this manuscript could convey the contempt with which their efforts were viewed by the "practical" draftsman. Nor were these men in agreement among themselves, nor were their views always practical. Following in large measure the traditions of earlier works, textbooks dealt generously with geometrical construction, practical descriptive geometry, exercises in the use of instruments, and meagerly, if indeed at all, with the application of such knowledge to graphical description.

These "old timers" even resented somewhat new ideas, as may be inferred from this comment by MacCord about drawing ink. "The best is of Chinese manufacture and comes in sticks or cakes of various sizes and forms; this is to be simply rubbed up with water to any desired density. The labor of preparation, slight as it is, is to some persons a great bugbear; and in response to their demands, various 'liquid India Inks' are offered for sale; the bottles, when properly cleaned, are good; which is more than can be said of the contents."

In those days, draftsmen and professors alike were still arguing about the proper form of delineation, about the proper arrangement of views. This period was about the turning point of that fine old war between those who favored the *first quadrant* against those who favored the *third quadrant* method of representation.

To quote one author, "By this plan the horizontal and vertical projections are made with the object at

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This article is based on a portion of "The Development of Graphical Representation," by Frederic G. Higbee, published in the **Journal of Engineering Drawing**, May 1958. The article was reprinted in the **Journal** by special permission of McGraw-Hill Book Company, from "Proceedings of the Engineering Drawing Division Summer School," conducted at Washington University, St. Louis, Mo., in 1946.

rest on the horizontal plane. To illustrate, a brick will do. First, plan, brick lying down flat, view from top shows it eight inches long, four inches wide. Second, side elevation, board shoved behind brick, and figure of brick marked on it, two inches high, eight inches long. Third, end elevation, board raised on the right and figure of brick drawn on it, two inches high, four inches wide. This is the same effect as though the draftsman marked around the brick as it lay flat, then turned it up, directly on the side from him, and scratched around it again. This scheme discountenanced acrobatism and all manner of inebriated posturing in the object and conserved for it a respectable representation. . ."

Commenting somewhat tartly upon articles similar to the foregoing on projective drawing, Oberlin Smith wrote in 1875, "The writers of the recent essays upon the above seem to dwell particularly upon the doctrines of descriptive geometry, although some of them ring the changes upon other imaginative methods of conceiving what a drawing means, such as walking around the object represented, or climbing up on top of it, or burrowing underneath it, or looking at it through transparent paper, or through glass, or having its various sides depicted upon paper which may be supposed to be wrapped around it, and which afterwards may be peeled off, after the manner of skinning an onion, etc.

"This question of which way to project cannot in the nature of things be of such very great importance in itself, like theology, or so many good people would not differ regarding it. Let us then all strive to come to a common practice in the matter and meet upon common ground of *direct* revolution if we can, or *indirect* if we must. Let us remember, however, that America is all the time becoming less provincial and that this common ground should be international, rather than merely occidental."

Thus, even so early as 1875, is found a far-sighted plea for standardization and for uniformity. Amusing as many of these ideas of graphic representation now may seem, yet out of the unrest and dissatisfaction here expressed, gradually evolved a new period in the development of graphic representation, and a greater stability in the art of graphic expression.

Notes & Comment

Name Change

SOME READERS may have noticed that we have dropped the sub-head, "The Magazine for Draftsmen," from our name. This is done, not as a reflection on the draftsman, but in order to describe more accurately the purpose and coverage of the publication. The sub-head has been replaced by a statement on page 3 which reads: "The magazine of engineering drawing management, covering all phases of drafting, reproduction and microfilming, technical illustration, drawing standards and drawing filing in all industries."

It is our desire to have the term "graphic science" apply in a broad sense to all graphical methods used in engineering. This was the philosophy followed in the conception of the magazine; and it has been our guide in determining editorial and circulation policies.

Women In Architecture

ACCORDING to a recent article in *The New York Times*, the question of how many women architects there are in the U. S. is a difficult one to answer. The American Institute of Architects, the profession's national organization, has 13,000 members, about 100 of whom are women; some of these, however, are draftsmen, as yet unlicensed to practice. Informed estimates are that, out of approximately 13,000 registered architects, women comprise only 2 per cent, or 260.

Equally difficult to answer is the question of how many women draftsmen there are in industry. During World War II, women were recruited for drafting jobs, and enrolled in "crash" training programs at company (or Government) expense. How many, we wonder, are still at work in one of the many segments of this lively field?

Seminar-Workshop

AS WE GO TO PRESS, the 17th Tecnifax Seminar-Workshop in Visual Communication is being held (April 19, 20 and 21) at Holyoke, Mass.

Commenced in December 1954, at the request of a U. S. Navy Command, with 25 registrants, this unique event is now a semi-annual affair. This April, Tecnifax is playing host to 600 qualified registrants, accepted on a "first-come, first-served" basis. Tecnifax Corporation provides auditorium, workshops, instructors, equipment and materials for these Workshop-Seminars. Outstanding speakers from industry, education, and government are included on the program.

Dedicated to the belief that every communication process which can produce effective results should be put to use, Tecnifax is also host semi-annually, to personnel from other organizations who conduct workshops in communication techniques utilizing materials other than diazotype.

This event will be coming up again in October 1960. For more information, address Tecnifax Corp., 195 Appleton St., Holyoke, Mass.

Expansion

ABOUT THE MIDDLE of May, it is anticipated that Anken Chemical & Film Corp., Newton, N. J., will consummate the purchase of the Photo Copy Section of the Photo Records Division of Sperry Rand Corporation. The facilities being purchased consist of two plants—one at Newton, N. J., the other at Williamstown, Mass.—and related inventory.

The Photo Copy Section produces and sells photographic materials for use on office photocopy machines, including Remington Rand's Dexigraph, Portagraph, and Transcopy models. Anken will continue to manufacture these materials, and will also market the Dexigraph, Portagraph, and Transcopy machines.

MARS vs MARS — You need neither lawyer nor judge. Let your own preference decide in favor of one MARS over another. For whether you pick one of the wood-cased Lumographs or one of the Technicos you'll be using the very finest.

Among the famous imported Mars drafting products are: the Mars-Technico push-button lead holders (with adjustable degree indicator*, with specific degree imprint*, the economy model*); Mars-Lumograph drawing leads, 18 degrees, EXB to 9H; Mars-Lumograph drawing pencils*, 19 degrees, EXEXB to 9H; Mars-Duralar pencils and leads for drafting on Mylar®-base drafting film —5 special degrees, K1 to K5; Mars-Duralar Technicos with adjustable Duralar degree indicator; Mars-Lumochrom colored drawing pencils. 24 shades. Also: Mars Pocket-Technico for field use; Mars pencil and lead sharpeners; Mars Non-Print pencils and leads; Mars-Duralar erasers. Mars products are available at better engineering and drafting material suppliers everywhere.

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Engineering Drawing Reproduction

How one company simplifies its drafting operations by using up-to-date reproduction techniques

by Robert P. Kowalsky

THE PROPRIETOR of 22 plants in the United States, Canada, England, Mexico, and Australia, Allis-Chalmers Manufacturing Company employs some 40,000 persons. It produces a wide range of products, including tractors, power engineering equipment, electric controls, transformers, and hydraulic turbines.

Because of the various types and sizes of products manufactured, drafting problems vary, with the result that one reproduction method may be valuable to certain of the company's engineering departments but useless to others.

At the West Allis Works, largest of the company's operations, the Reproduction Department is under the supervision of the Manager of Office Services. The output of this Reproduction Department includes the making of whiteprints (both ammonia process and moist print process), cloth blueprints, photographic negatives, phototracings on cloth (duplicate tracings), sepia line reproductions on paper and cloth, autopositive transparencies, microfilms and microfilm enlargements, photostats, and electrostatic plates for offset duplicating.

Other types of reproductions, such as negatives reduced from large drawings for instruction book requirements, and printed standard forms for drawings are at times purchased.

Improved Techniques

IN RECENT YEARS it has been much easier to produce better prints faster. Print machines now run at speeds up to 75 fpm using lamps with intensities of up to 150 watts-per-inch. This compares with a maximum of 75 watts-per-inch a few years ago. One of our operating problems is making ten or more prints from tracings that are in very poor condition. It is obviously a big advantage to be able to produce prints from one of these tracings in ten minutes at a speed of 6 to 8 fpm as compared with 20 or more minutes at a speed of 2 or 3 fpm required only a few years ago.

Now it is often practical to order whiteprint reproductions from letters on bond paper. It is possible to make a print from a print. These improvements have made it feasible for us to greatly improve our production without increasing the number of print machines, number of people, and floor space required. Labor and material cost increases, experienced during the past few years, have been offset by productivity increases.

We have established cost rates for each kind of reproduction. These cost rates include overhead expenses, and are used to allocate charges to the departments using these services. The established rate for whiteprints includes folding, and hourly messenger pick-up and delivery service.

Photographic negatives are used to make phototracings or duplicate tracings. They are best used if made reverse reading, i.e., with the image appearing reversed on the surface of the sheet. The surface of a reverse-reading negative is placed in contact with the surface of the sensitized phototracing cloth. It is then unnecessary to pass the light through the negative paper which is more opaque than the phototracing cloth. This reduces the light diffusion and sharpens up the line image for a better reproduction.

Terminology

TERMINOLOGY is often a confusing problem. A reproduction can be positive or negative, and the image on the reproduction can be direct-reading, or reverse-reading. Positive reproduction has dark lines and lettering, light background; negative reproduction has dark background, light lines and lettering. A direct-reading image is a normal-reading image, from left to right. A reverse-reading image has letters reading from right to left as would be observed in a mirror. The folowing basic combinations result: direct-reading positive, reverse-reading positive; direct-reading negative, reverse-reading negative. Confusion is bound to result when someone asks for a negative, if

what they want is a reverse-reading negative or else a reverse-reading positive. They will probably receive a direct-reading negative.

The advantage of the reverse-reading principle, and control of terminology in ordering such reproductions, is a definite part of a simplified drafting program.[1] Failure to use the reverse-reading principles when conditions warrant, lowers the image quality of copies. Improper use of terminology causes waste, expense and delay.

Types of Prints

Phototracings are usually made on wash-off type cloth. These are preferred because it is unnecessary to use an eradicator when making changes. Sepia line reproductions on paper are simply and economically made in one operation directly on the ammonia or moist print machines. The permanency of these is not well established, however.

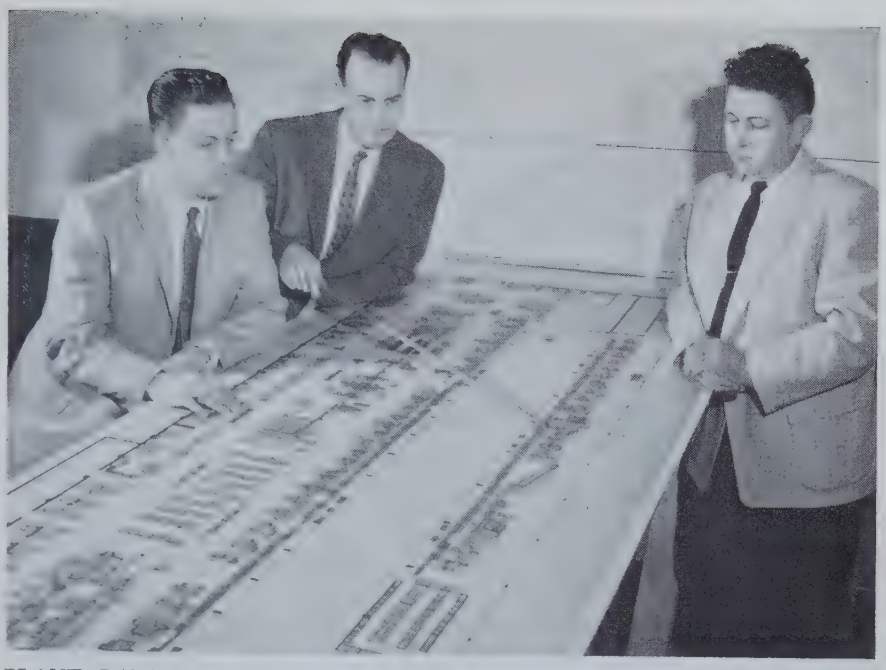
Sepia line reproductions are also available on cloth. This process saves the expense and time of making a negative and can be produced quickly. They are best used as duplicates from drawings of good quality.

Autopositive transparencies on paper are made directly from the original drawing by the darkroom process. This process is similar to the making of photographic negatives and results in a positive instead of a negative. The image is permanent but corrections require eradication. Reproduction quality is good because the image is "reflexed" from the surface of the drawing. Dirt from the back of the drawing, and cracks in the paper are not reproduced.

Microfilm pictures are taken of all our drawings for protection against fire, etc., and for use in making enlargements. Enlargements are made from microfilm where the drawing has been destroyed or when a tracing is badly worn. A schedule has been set up for destroying drawings when they are no longer likely to be required.

Electrostatic plates combined with offset duplicating are often used for making copies from drawings in larger quantities. They are also used to make copies of standard drawing forms on vellum or cloth.

[1]A lexicon of standard photodrafting terminology in use at Allis-Chalmers is currently being compiled, and when completed it will be presented to GRAPHIC SCIENCE readers.—The Editor.



PLANT LAYOUT arrangement, consisting of scale cutouts on polyester film, is studied by members of the Plant Engineering Dept. at Allis-Chalmers West Allis Works.

Reproduction Considerations

Anything which will reduce drafting time is given a lot of attention today. We all know how the expanding business picture has affected the demand for engineers and draftsmen. The rapid and continuing increase in labor and operating expense has caused all of us to take long and frequent looks at work simplification methods. Today it is necessary to make many more pictures and process drawings, along with an increased number of dimensions, notes, specifications, instructions and reference numbers.

The wear each drawing will receive dictates whether it will be provided on vellum or on cloth. The rate of usage determines if it will be reproduced on phototracing cloth, by sepia reproduction, by the electrostatic-offset duplicating process, or by a printer.

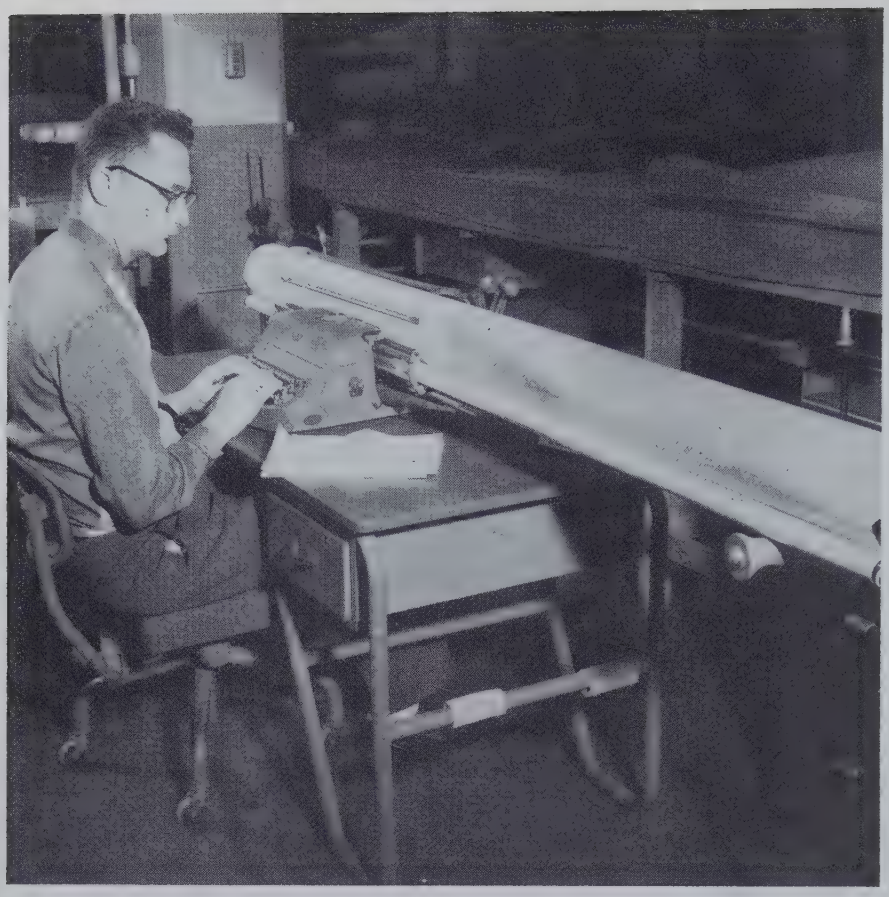
Ink tracings are becoming a luxury. Almost all of our drawings are in pencil. Those pencil drawings which are used heavily become so dirty that it is difficult or even impossible to obtain usable prints from them. If caught in time, duplicate tracings can be made to improve conditions. Our Compressor and Electric Control Departments, however, order duplicate tracings on wash-off cloth immediately upon completion of certain drawings. The photographic reproduction process intensifies lines, with ink-line-quality results.

Although the individual applications of reproduction methods used to simplify the drafting operation at Allis-Chalmers are numerous, the basic methods are few. These are discussed below.

Repetitive Information

The simplest and most obvious place to apply reproduction methods to simplify drafting is in cases involving frequently used listings or part drawings which carry a considerable amount of standard information.

An interesting example may be found in our Motor and Generator Department drawing lists. The drawing list of the major parts is a standard form. The entries for a given type of motor or generator consist largely of fixed and repetitive information. However, the number of sheets showing various groupings is high, while the usage on each group is low. The solution was to have 100 of these drawing list formats printed on offset masters. The fixed and repetitive entries were typed on the offset master in an engineering typewriter and these were run on an offset duplicating machine onto vellum sheets.



ENGINEERING TYPEWRITER is used at Allis-Chalmers for bills of material, process specifications, etc., to save considerable amounts of drafting time.

Drilling Templates

Our Control Department made drilling template drawings and had a number of copies made by the electrostatic - offset duplicating process.

The sizes of the various control panels were outlined on a large vertical steel board in the Engineering Department. Paper templates for the various units to be mounted on a panel are then obtained from nearby bins and placed on the vertical board with magnets. It is a simple matter to see if they will fit, and this procedure has eliminated the drafting layout. When the order and specifications are sent to the shop, a set of these templates goes along. These are mounted on the panel and drilling is done from locations and instructions shown. Manufacturing layouts are eliminated.

Use of Electrostatic Prints

A relatively small but helpful application is the use of electrostatic prints on spare parts lists. Whiteprints permit copying on only one side while the electrostatic and offset duplicating process permits copying on both sides. It is a considerable advantage to transmit 50 sheets of paper to a set instead of 100 sheets, particularly if many sets are required.

Use of Negative Intermediates

Frequent, too, are instances where the new order calls for construction similar to existing designs. For example, a two-stage compressor is called for, similar in design to a previously built four-stage compressor except that the locations of the thrust bearing and load bearing are reversed. In this case the negative intermediate is opaqued to blot out these areas, or areas are cut out and replaced by the wanted parts which are taken from drawings of the previously built similar design.

Dual-Purpose Drawings

Another application involves using the picture of a major part for both the production drawing and the instruction book drawing. The picture-drawing is prepared and a duplicate tracing is made. On one, the itemization, large size lettering, and other details required for instruction book purposes are added; on the other, the dimensions, bill of material and other information are added for manufacturing requirements.

Vendor-Parts Reproductions

Where we have been called upon to make reproductions from prints of parts furnished by suppliers we have had success in making a 35mm microfilm picture and an enlargement from it. The department then adds its drawing number. This procedure has been used to advantage when it has been impossible to get the needed number of prints, or sepia, or equal, from the supplier.

Plant-Layout Applications

Our Plant Engineering Department has made good use of sepia paper and clear- and matte-finish acetate to keep layouts of machine facilities and locations up-to-date.

The procedure involves the making of ¼-scale master layouts of each shop area. The building outline and columns are entered with black tape on clear acetate material. Aisleways and transfer tracks are cut from sepia acetate copies and attached with tape, gummed on both sides. Sepia acetates are printed from the scale outlines of the machine tools; these are cut out and taped to the layout. These layouts can easily be kept current and it is simple to make revisions. A sepia paper copy is made from the master layout and prints are made from it.

A typical problem in the Plant Engineering Department is giving consideration to rearrangements in shop areas. This is done by placing the cutouts of machines, aisles, etc., on an acetate sheet. The cutouts are borrowed from the master layout, or duplicates in file are used. A sepia paper copy is made and approvals are entered on this.

Non-Reproducible Grid Lines

A number of our departments are using vellum with grid lines which do not reproduce. Typical

applications are preliminary drawings, sketches, proposal drawings, power house drawings, etc.

Formerly one department made a preliminary sketch of a schematic wiring diagram which was then drawn up. Now it is sketched on vellum with grid lines and serves as the working drawing. Attention is given to sketching simple detail drawings on this type of paper to eliminate the tendency toward making all drawings finished works of beauty.

Polyester Film

Many departments are using a polyester film for drawings and sepia reproductions. More durable than ink or pencil cloth, it is being used to make multiple copies for standard applications which include minor variations.

Our Tool Engineering Department uses this film to make sepia positive reproductions. The process drawings for rows of steam turbine blading are closely related within small groups and much of the material on the drawings is identical. The sepia reproductions are made reverse-reading, and the missing and variable entries are placed on the reverse side. At present, these are made on sepia cloth.

Drawing Restoration

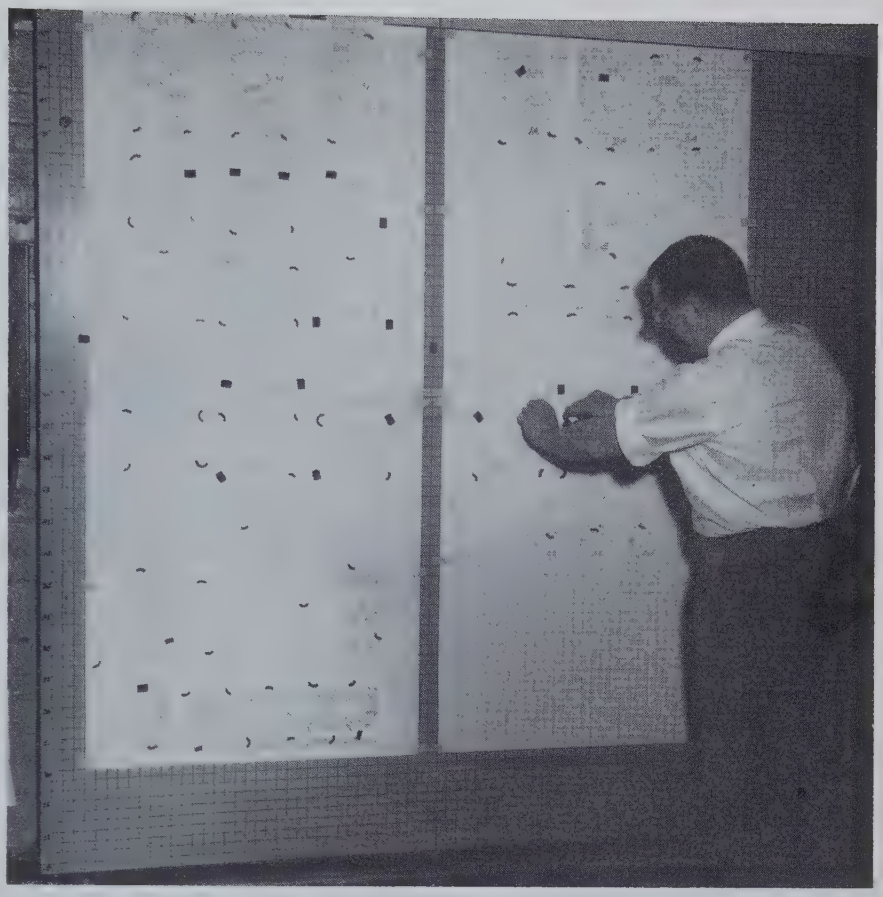
We spend considerable time and effort attempting to restore badly worn tracings to a usable condition. When the photographic negative and phototracing procedures have failed to produce satisfactory results, we have had good success with microfilm enlargements from our 35mm film. When this has not worked, we have made a number of full-size contact negatives in a camera which advantageously takes the image from the surface instead of pushing light through the sheet. In one instance a 105mm picture was taken of the original and an enlargement made from this negative with good results.

Microfilming is also used to supply reproduction copies to a customer.

Transfers

Transfers have been given active consideration by most of our departments. Although they are not, in the complete sense, a reproduction method, it is helpful to be able to attach this film-like screen to a drawing and make prints.

We are applying this item by printing our drawing bill of material on these transfers. We then cut our bill of material to the desired length and place it on the drawing wherever we wish. By combining this with the engineering typewriter, we have taken the entire preparation of the bill of material out of the hands of the draftsman and freed him for more important work.



PAPER TEMPLATES for various control panel layouts are mounted with magnets to a steel board in Allis-Chalmers Engineering Dept., in place of drafting layout.

Electrostatic-Offset Duplicating

We have been considering the use of the electrostatic-offset duplicating process to furnish reduced-sized prints. Drawings up to 22″ x 34″ can be reproduced at reductions in size of up to 50 per cent (11″x17″). This process should be applied only when ordering quantities are large enough to pass the cost break-even point. More important, care must be taken not to furnish the manufacturing group with drawings which are illegible when reduced.

The advantages, however, are numerous. The cost-reduction feature is attractive. The file space-saving is considerable. The convenience of reference when using the smaller sheets is helpful, and additional prints can be run off at negligible cost.

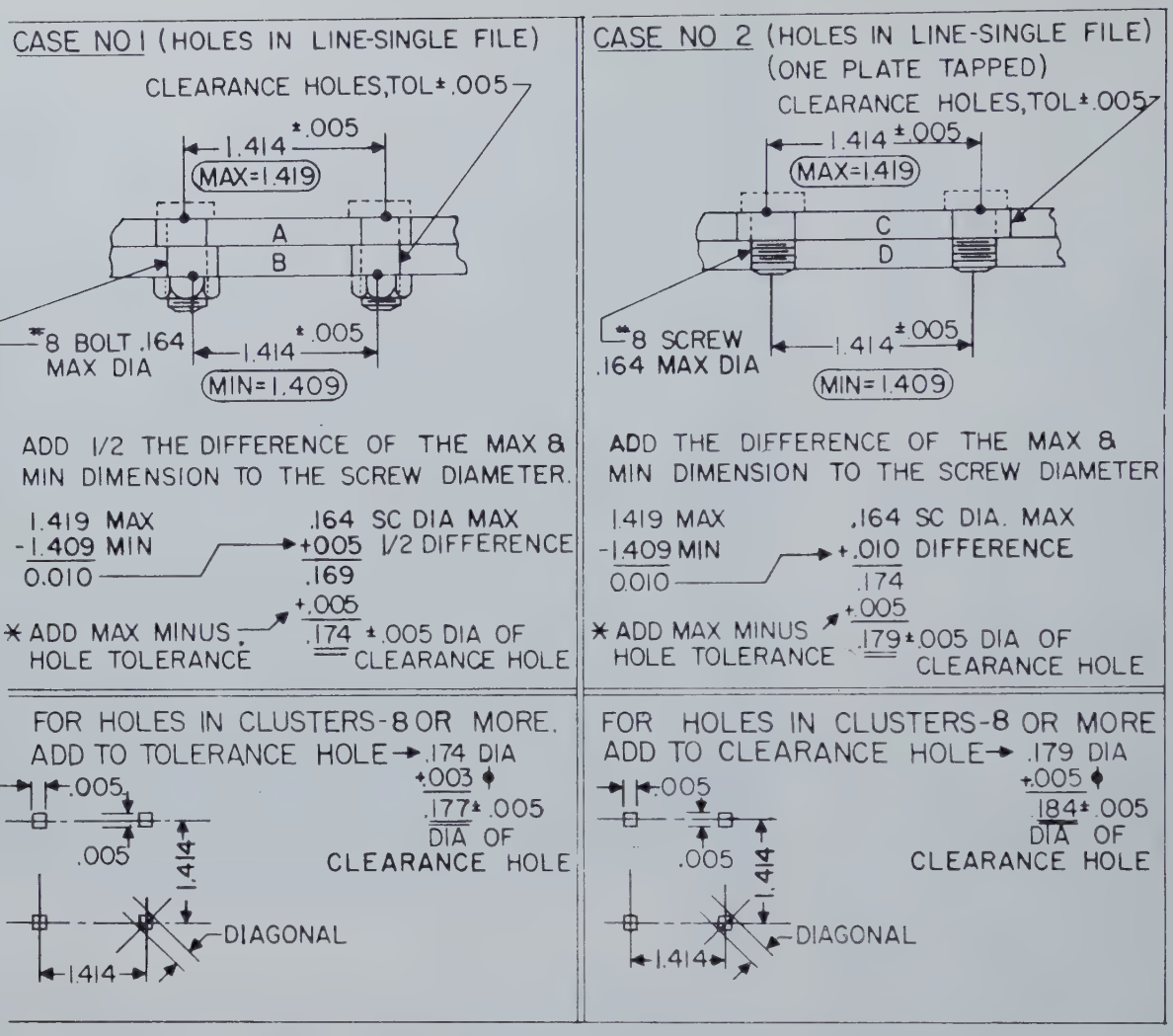
An added advantage is the reduction of wear on the drawings. An electrostatic picture can be taken by handling the drawing but once. If additional prints are run off to furnish a "stock print" or print replacement program, it is unnecessary to repeatedly pull the drawing out and dispatch it for these replacement prints.

Also worthy of consideration is the making of sepia, autopositive, or equal, to use for running off prints.

The Author

Robert P. Kowalsky is Supervisor of Engineering Services, Motor & Generator Dept., Allis-Chalmers Mfg. Co., Milwaukee 1, Wis. He joined the company in 1936, and has served as supervisor of offices and blueprint rooms.

Illustrations courtesy of The Magnavox Company.



CASE ILLUSTRATIONS. These apply to all problems in hole tolerancing, given the maximum difference in the hole centers due to tolerances, determine the clearance hole sizes required.

True Position Dimensioning

A graphic presentation for drafting personnel

by Walter H. Friedrich

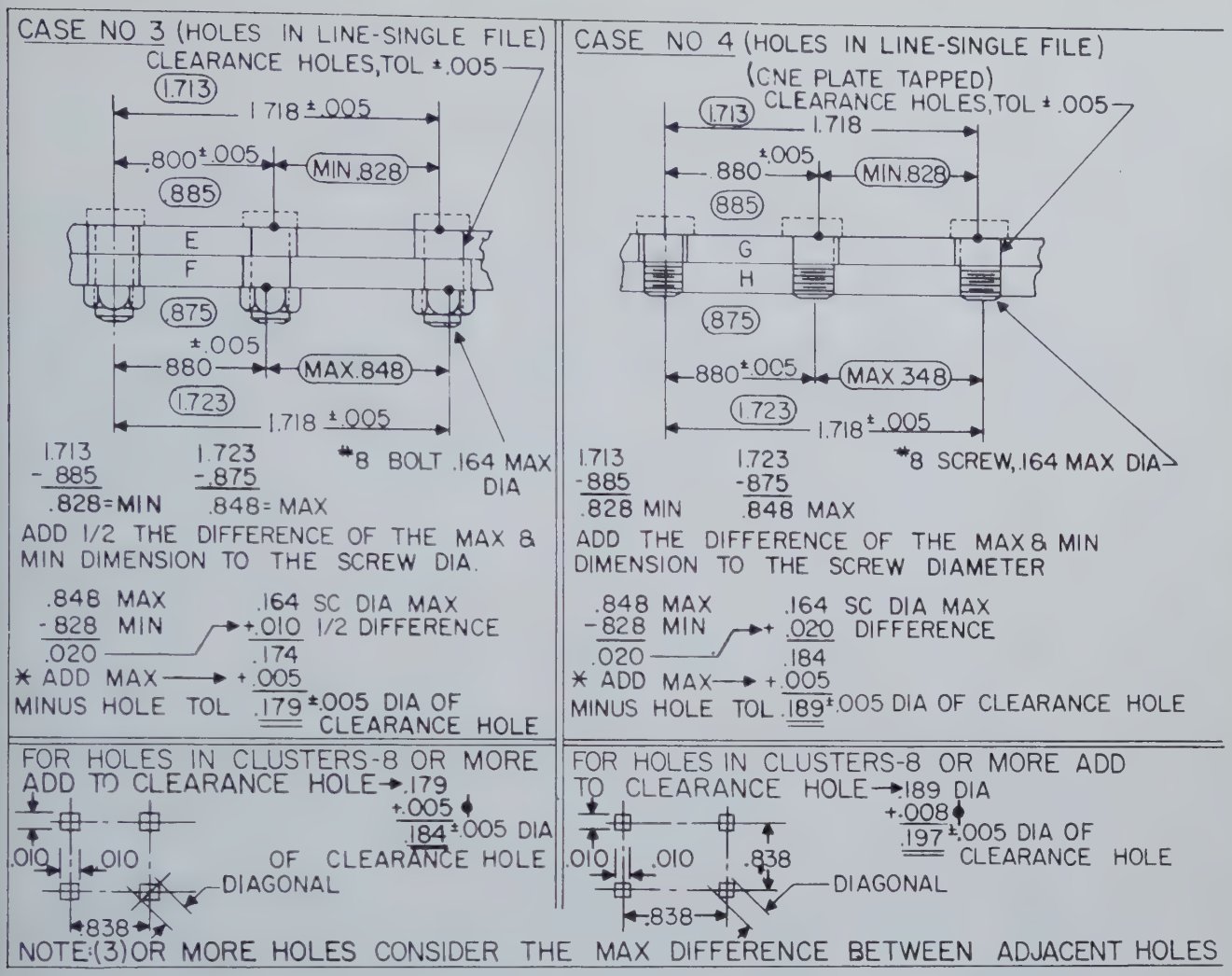
A CHART OF MAXIMUM centerline tolerances was first issued to drafting personnel at The Magnavox Company, Fort Wayne 4, Indiana, in 1945. Since then, a process of gradual evolution has resulted in the graphic system presented on the following pages. In its present form, this system has been in use at Magnavox since March 1959.

The resultant saving in drafting time is comparable to the time saved in using the handbook to find squares, cubes, chords, circumferences, etc. In addition, parts designed with the use of this system of tolerances can be fabricated with confidence that there will be no interference during assembly.

The following notes are issued to drafting personnel at Magnavox, as an accompaniment to this graphic material.

TRUE POSITION DIMENSIONING AND NOTES

THE GRAPHIC ILLUSTRATIONS on the following pages are intended to be used as an instruction sheet by



* The following applies in all cases; when a minus tolerance is called for on any of the hole diameters, the maximum tolerance (in these four cases .005) is added.

† This represents the amount added for the true position system of dimensioning.

Note 1: Use TABLE OF CALCULATED HOLE SIZES (page 18) whenever possible.

Note 2: If the part is drilled and the clearance hole is not a standard drill diameter, use the next size larger drill.

See page 18 for the Table of Calculated Hole Sizes

the Junior Draftsman. They show how clearance holes are calculated for the different types of assemblies using the more common tolerances. If it is desired to find the clearance holes for tolerances other than those shown, follow the same procedure, substituting these tolerances.

When holes are in clusters, the true position system of dimensioning must be used. In this system of dimensioning, the corners of the square tolerance zone are the maximum allowable variation. In conventional practices in the past, locations were given by polar coordinates, each with its own tolerance. This did not give an accurate tolerance condition. To determine this amount for cases 1 and 3 (see illustrations), the difference of the diagonal and side of the tolerance square is added to the "holes in line" clearance hole. For cases 2 and 4 (see illustrations), twice this difference is added. In cases 1 and 3, this is .003 and .005; in cases 2 and 4, it is .004 and .008 respectively.

When all parts are made to the extreme tolerances, it is possible to have a condition where the screw diameter and the hole opening is the same dimension. This is the exceptional case, and no allowance has been included in the Table.

The Table and formulae do not include allowances for holes whose axis is not at right angles. Angular tolerance need not be considered in punched holes, but when drilling through thick material, allowance must be made for out-of-squareness.

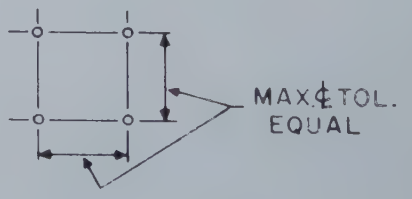
Rivets are special cases and their hole centers must be held extremely close. The chart, therefore, is not applicable to rivets.

The Author

WALTER H. FRIEDRICH, originator of the graphic method of true position dimensioning presented on these pages, is Engineering Coordinator at The Magnavox Company. Fort Wayne 4, Indiana. Prior to assuming his present position, he functioned for 15 years as Chief Draftsman.

MAXIMUM CENTER LINE TOLERANCE, VERTICALLY AND HORIZONTALLY		SCREW SIZE		#2 .086	#4 .112	#6 .138	#8 .164	#10 .190	#12 .216	1/4 .250	5/16 .312	3/8 .375	1/2 .500
	±.005	CASE NO.1	L	.096	.122	.148	.174	.200	.226	.260	.322	.385	.510
			C	.099	.125	.151	.177	.203	.229	.263	.325	.388	.513
		CASE NO.2	L	.101	.127	.153	.179	.205	.231	.265	.327	.390	.515
			C	.106	.132	.158	.184	.211	.236	.270	.332	.396	.520
		CASE NO.3	L	.101	.127	.153	.179	.205	.231	.265	.327	.390	.515
			C	.106	.132	.158	.184	.210	.236	.270	.332	.395	.520
		CASE NO.4	L	.111	.137	.163	.189	.215	.241	.275	.337	.400	.525
			C	.120	.146	.172	.198	.224	.250	.284	.346	.409	.534
	±.010	CASE NO.1	L	.101	.127	.153	.179	.205	.231	.265	.327	.390	.515
			C	.106	.132	.158	.184	.210	.236	.270	.332	.395	.520
		CASE NO.2	L	.111	.137	.163	.189	.215	.241	.275	.337	.400	.525
			C	.120	.146	.172	.198	.224	.250	.284	.346	.409	.534
		CASE NO.3	L	.111	.137	.163	.189	.215	.241	.275	.337	.400	.525
			C	.120	.146	.172	.198	.224	.250	.284	.346	.409	.534
		CASE NO.4	L	.131	.157	.183	.209	.235	.261	.295	.357	.420	.545
			C	.148	.174	.200	.226	.252	.278	.312	.374	.437	.562
	±.015	CASE NO.1	L	.106	.132	.158	.184	.210	.236	.270	.332	.395	.520
			C	.113	.139	.165	.191	.217	.243	.277	.339	.402	.527
		CASE NO.2	L	.121	.147	.173	.199	.225	.251	.285	.347	.410	.535
			C	.134	.160	.186	.212	.238	.264	.298	.360	.423	.548
		CASE NO.3	L	.121	.147	.173	.199	.225	.251	.285	.347	.410	.535
			C	.134	.160	.186	.212	.238	.264	.298	.360	.423	.548
		CASE NO.4	L	.151	.177	.203	.229	.255	.281	.315	.377	.440	.565
			C	.176	.202	.228	.254	.280	.306	.340	.402	.465	.590

TABLE OF CALCULATED HOLE SIZES



L = Holes in line, single file;
C = Clusters, in groups of eight or more.

Note 1: For CASE ILLUSTRATIONS, see pp. *16* and *17*.
Note 2: Hole diameter tolerance ± .005.
Note 3: Holes marked as shown require washers under both head of screw and nut.

The German Drawing Instrument Industry

History and Sociological Background

by Frank Oppenheimer

It is known that the early Egyptians and Romans, and other contemporary civilizations used a compass-like instrument. But the basic form of the compass as it appears today is known to have been in existence in Germany as early as the year 1200. The *Guild of Compass Makers* is mentioned in the old books of the City of Nuremberg in the year 1442. Their early instruments were originally made of wood, and later on, of iron. The iron instruments were hand-forged and because of this, the literal translation of the name of the Guild in German was *The Guild of the Compass Forgers.*

The first brass instruments made their appearance in Germany at the beginning of the 16th century and through the years, up to the end of the 18th century, brass was used exclusively. However, the instruments were no longer forged. They were die-cast. The oldest ruling pen known is the instrument used by the famous painter, Albrecht Durer, who lived in Nuremberg from 1471 to 1528. This ruling pen was made of brass.

Statistics from the archives of the City of Nuremberg show that during the year 1590, there were 85 members of the *Guild of Compass Makers* at work; during the year 1658 there were 105; in 1670 there were 110; and in 1724, there were 107.

Despite this activity, the first precision instruments were manufactured not in Germany, but in Switzerland. Around the year 1770, a mechanic by the name of Esser started manufacturing in Switzerland, and in 1819, Kern, who had been an apprentice in the Esser factory, founded the firm of Kern & Co., in Aarau, Switzerland. The Swiss took over the basic forms of the old German compass as it was manufactured in Nuremberg, improving on the entire form, particularly the head. The material was brass and for the first time, rolled sheets were used, from which the pieces were cut out. Up to around the year 1880, the Swiss instruments were made exclusively by hand.

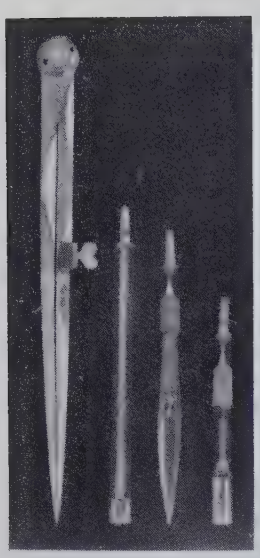
For many years, the Swiss instrument manufacturers were the leaders in this industry until in South Germany in the Bavarian Alps a new industry developed. Around the year 1830 a mechanic named Haff was employed in the factory of Kern in Switzerland. In 1835 he founded the first factory in Pfronten, and it was through him that the Swiss system was transferred to Germany.

Square System with Pivot Head

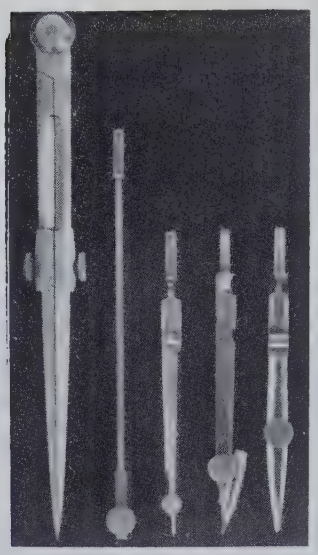
Shortly thereafter, in 1840, Clemens Riefler, who was an apprentice in this first German firm, started his own manufacturing in Nesselwang, about four miles from Pfronten. He, too, started with the Swiss system, but in the year 1843 Clemens Riefler introduced his own invention, the pivot head. In 1854, Riefler exhibited these instruments for the first time, at the Industry Fair in Munich, under the heading *Compasses with Pivot Heads and Ball Motion.* With the exception of the head design, the form of the compass still was similar to the square system of the Swiss. In 1855 Riefler exported this type to the United States for the first time.

In the year 1870 Haff abandoned the Swiss type and took over the Riefler square type with pivot head and from then on this type was commonly referred to as the "Haff System."

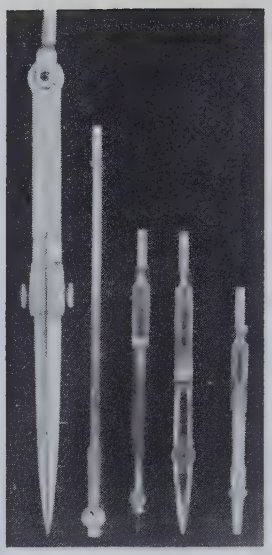
In the meantime Riefler forged ahead, making various improvements in the whole form of the instrument as well as in the head design. This is what Theodore Alteneder found in the years 1841 to 1848 while he was working as an apprentice in the Riefler factory. In 1848 Alteneder emigrated to the United States and started to manufacture instruments in Philadelphia. They were the same square type with the new pivot head which he had first learned to make in the Riefler factory at Nesselwang



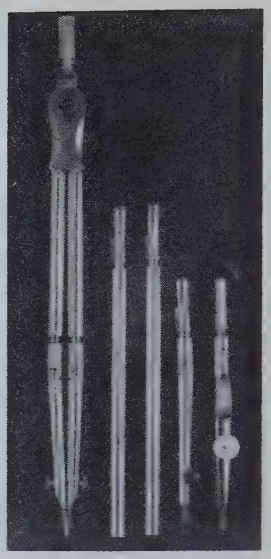
OLD German Compass. Circa 1780



SWISS System, 1840. (Riefler Square Type)



SQUARE type (Riefler) with pivot head; since 1843.



ROUND type (Riefler) with pivot head; since 1877.

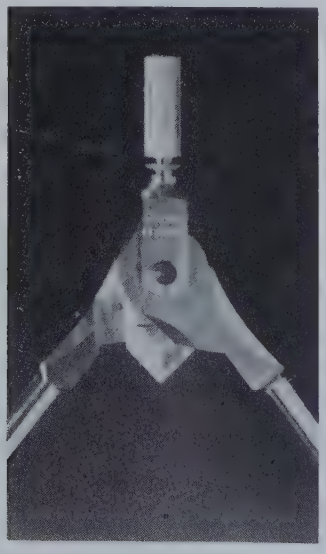
in the Bavarian Alps.

In 1875 the Riefler firm introduced its new invention, the round system. The name round system is derived of course from the tubular form of the compass legs and attachments. The success of the round system all over the world was tremendous and the name of Riefler was established. By the way, the round system never became too popular in the U.S.

The Flat Type

During the same year, 1875, a young watchmaker in Chemnitz, Saxonia, by the name of Otto Richter, had started the production of drawing instruments according to the Swiss system. It was not until 1892, however, that Richter's new invention, the flat type, was patented. This system, originated by Richter, has set the pattern for drawing instrument manufacture all over the world. In Germany, France, Italy, England—indeed all over Europe—instrument manufacture was stimulated because the flat system lent itself better to machine production, eliminating the slow and costly handwork processes which the square and round systems require even to this day.

In the meantime, in the Nuremberg area, various factories came into existence manufacturing along the already well established lines. One noteworthy exception was the firm of Johann Chr. Lotter. The Lotter firm introduced a gear-device that kept the head of the compass straight.



ROUND type (Riefler) since 1877; pivot head with self-centering device.

Improvements

During the year 1900, in Nuremberg and the upper Bavarian area, approximately 675 workers were employed in about thirty-five factories. Although the different systems underwent great improvements during the fifty years following, the types remained basically the same until the recent development of the giant bow type with its friction head and centerscrew adjustment, and an entirely new beam compass. More recently, a so-called "quick-action bow" was developed. The need to use pressure to draw pencil circles led to the construction of these compasses with greater stability, easy adjustment and additional security in the obtaining of the desired distances. This was the first time that American ingenuity and modern technical experience were combined with the conservative methods of the old country, to produce precision drawing instruments.

In the 19th century, the better instruments began to be made of nickelsilver. Nickelsilver is an alloy of copper, zinc, and nickel. The nickelsilver originally came from China to Europe in 1820, and in 1825 was first manufactured by the firm of Geitner in Saxonia under the name of Argentan. It is generally known today under the name of "German Silver." Good nickelsilver should contain 18 per cent nickel. The nickel content gives the metal its silver-like

FLAT type (Richter) since 1892; pivot head with self-centering device.

color, its non-corrosive capacity and its better workability. Haff has used nickelsilver since 1850, Riefler since 1860, and Richter since 1890.

Tradition of Craftsmanship

The unmistakeable stamp, the singular character of the German drawing instruments comes from the attitude of the craftsmen, their initial schooling, and their long experience at similar tasks under the same company's direction. The industry today is, of course, an outgrowth of the old Guild system, where special-

the attitude of the craftsmen, their own right. It had its roots deep in a Crafts atmosphere where knowledge is handed down from father to son.

In order to maintain the traditional workmanship, it is an old custom in many areas that, as soon as the boys are ready to leave school at the age of 13 or 14, they are brought by their fathers into the factories where they themselves work, to start their apprenticeship. Skill is the basis for achieving the highest quality in instruments; and to maintain a staff of skilled workers at all times, the bigger factories have their own Apprentice Departments. Apprenticeship means at least three-and-a-half to four years of study and practical work, after which a rigid test, demanding practical and theoretical knowledge, must be passed. This test is administered by and under the supervision of, the government. In every factory in which apprentices are educated, there are special foremen, supervisors and instructors just for this purpose.

After passing their examinations, the ex-apprentices are then hired as regular workers and integrated into the labor staff. These men seldom make a change. Their entire lives are spent with the masters who gave them their original schooling. Their homes and their farms, which are handed down from generation to generation, add to the stability of this type of life. Thus they are fully integrated into the production family. There are families whose male members have been working with the same firm two and three generations.

A Way of Life

In factories and homes, men and women are busy turning out instruments according to methods handed down through generations. They feel free to work either in the factories which sometimes are built within old stables, or to work in their own homes where they sometimes have small machines put up right in their living rooms or bedrooms. This gives the worker a feeling that he is his own boss and therefore he develops a sense of responsibility towards good work. The *ethos* or essentialness of the "work" itself is still apparent in Germany today. Especially in the rural districts there are a great number of men and women who still prefer to work in their homes. During the different seasons, it gives them an opportunity to tend their livestock and farms and do outside work, whenever necessary.

BOYS of 13 or 14 start their apprenticeship in instrument industry.

SKILLED older craftsman works at home, carrying on unique tradition.

FACTORIES are well equipped, but not for systematic mass production.

Despite the fact that many of the workers have small machines in their own homes, a great deal of work is still done by hand, particularly assembling and polishing operations on ruling pens, dropcompasses, the regular three-bow compasses, and other individual pieces. The atmosphere of the homeworker, however, is transplanted into the factory and even though many of the larger factories have well-organized tool departments, milling machine, lathe, drill and benchwork departments, there is no systematic mass production as we know it. Nowhere in a German drawing instrument factory can you find a machine that will take the raw material and turn out a finished piece.

The Individual Worker

The individual worker is indispensable to craftsmanlike production. Certain operations like grinding, which play such an important part in American mass production are almost non-existent in Germany. The ruling pens, for instance, are roughly cut out on a milling machine and then ground out by hand on a stone in a slow but very precise process. Assembling is typically called in German *adjusting*. The individual pieces are carefully looked over for their precise fit, and if necessary, reworked before being put together so that the final inspection operation is merely an additional check before putting the finished pieces in stock. Many old hands with long years of experience are employed at this *adjusting* operation, because it is considered one of the main operations.

Instruments manufactured under such painstaking conditions should last a lifetime, given the proper care and attention. If abused, drawing instruments like any other fine product, will cease to function adequately. Much depends on the good sense of the user, his appreciation of fine and beautifully crafted instruments, and the pride and respect which he brings to his profession.

The Author

Frank Oppenheimer is president of Gramercy Guild Group, Inc., 116 Broad Street, New York 4, N. Y.

Engineering Drawing In the Electronics Packaging Field

Working requirements and advancement opportunities—along with some of the design problems—draftsmen will encounter in the electronics industry.

by John R. Carpenter

In the electronics industry, the electrical gadget is first born to the electrical engineer and is then provided with skeleton and clothing by the mechanical engineer. It will be a machine that will use electrical energy to perform some useful function. To make it, the electronics engineer will plan an ingenious arrangement of controller components through which the electrical enery will flow.

The components are mostly "store-boughten" shelf items. Some are designed to retard or resist the flow of current, others will split it up and direct it in multiple directions, some can increase or decrease its volume or its strength, others can store this energy and release it on command. The pipe-line between these components will be conductor wires.

The engineer will demonstrate and communicate his plan of electrical circuitry by making a rough circuit drawing. This circuit is, in essence, a map of the flow of electrical energy to, from, and through the various conversion and control components. He is, to put it mildly, no shining light as a draftsman. He will use standard symbols to represent the components, and lines to represent the conductors (wires). His schematic will be no thing of beauty but it will describe accurately all the parts to be used and how they are to be connected.

Subsequently, an electrical draftsman will convert his scrabble into a presentable record drawing. You can see that transforming this schematic into a physical fact will produce a sloppy collection of loose parts tied together by a complex of wires. This disorderly necklace of components will do the work that the electronics engineer has planned. It is obviously in no condition to be shipped to, or used by, a customer.

The Packaging Engineer And His Draftsman

It is here that the packaging engineer and his draftsman enter the picture. These two will set about to array the components on and into a suitable structure and to encase this structure in a proper housing. When this is done we have an electronic "package."

For these two the problems are manifold, and the rewards are mostly in the psychic satisfaction of problem solution. They have a difficult and important task. Their job is to take the electronic engineer's basket of components, and to generate a support structure for this, and then to mount each and every piece in such manner as will enable their interconnection and manipulation and maintenance.

They will do this—or try to—with an absolute minimum of space usage; and they will try also to present the end product to the potential purchaser in a suitable and attractive "package."

Problems

The considerations and the pitfalls are many.

The components and the conductors to be attached to the structure must be electrically independent (insulated) of it, lest this energy escape its ordained paths and flow in the wrong quantities, or at the wrong time, through the wrong component—or even, perhaps, through the operator.

The latter possibility is universally considered to be exceptionally poor engineering!

Editor's Note: This article is based on a talk given by the author at the Educators' Seminar, Design and Drafting Council of Delaware Valley, at Temple and Pennsylvania Universities in March 1959.

Space Limitations

There is never enough space in this package into which to shoehorn all the components, or in the area where the package is to be used. The spacially convenient and desirable location for a large and heavy piece will often be impractical in consideration of structure support. Many of these components get hot and will need to be adequately spaced to allow for cooling air circulation and to avoid the compounding of heats. Often the entire package will need to be air-conditioned. At the same time, certain other components operate properly only at a critical temperature and will be delivered to us, each encased in its own personal oven.

Conductor wires resist the passage of current. As the wire length varies the resistance will vary. This resistance can be predicted, but it is still a problem. The circuit designer will want as little of it as possible. The wire lengths—the distance from one point to another—must therefore be held to a minimum. Holding these minimums is not always compatible with the compact and orderly array of components.

Fragility of Parts

Some components are fragile. Consumer products need to be built to withstand only the rigors of transportation from factory to consumer. Industrial or military devices are apt to meet some pretty rough treatment. The design and incorporation of impact or vibration protection is an art by itself.

Accessibility of Controls

The placement of parts needed to permit operator manipulation is a very special consideration. These are usually behind a panel, and the controller portion projects through it to the outside. Like an iceberg, there is only a little of it visible and a lot of it hidden. A neat and advantageous placement behind the panel may seriously conflict with harmonious and utilitarian arrangement in the front.

Accessibility of Parts

Another headache is the ever-present requirement that any and every part must be accessible by tools, soldering iron, or fingers to permit extraction and replacement. It can be heartbreaking to leave all that unused space, but the field serviceman, threading his way through a too closely packed maze of components with a hot soldering iron, will love the designer who has not saved too much space.

The routing of wires and cables must be preplanned. A cable can be both bulky and obstinate about falling into tight corners but it has just as much right to space as any other component.

The designer is constantly balancing pros and cons, weighing advantage to disadvantage, holding where he must and compromising no more than he is forced. He is a space engineer with very little space. He has a large shoehorn and is long suffering. And with all this, if he knows his business, he tries to leave a little reserve. The electronics people are notorious for their tendency—after the structure has been designed—to suddenly need an additional or bigger part.

The Draftsman's Approach

The draftsman's approach will be via the layout. His criteria will be the parts to be used, which he will get from the schematic, and the element of space into which these parts need to be shoehorned. He first establishes the size, shape, weight, and mounting characteristics of each part. The general concept of the supporting structure will be either his own thinking or will be supplied to him by his engineer. If the parts are few, and familiar, his arrangement visualization —before committing himself to paper— may be mental. If the parts and the problems are many, he will often prepare cardboard scale cutouts of each part (we call them "dollies") and shift them about on a preliminary structure layout until he finds a pattern that will satisfy him, his engineer, and the sidewalk superintendents who occupy the adjacent tables. This point reached, the layout is completed to a minimum state and is submitted for the approval of a conference of other interested and affected engineering personnel.

Preparation to no more than minimum is wise, since the layout seldom gets through the meeting unscathed. If it gets through at all. The package will be too big, too small, too light, too heavy. More of this or less of that may be needed. All the problems of relating this unit to others with which it will live will be worked over. The draftsman, bloodied and somewhat bent, returns to his board to start all over again. Sometimes it takes a lot of layouts before everyone is satisfied.

Drafting Room Organization

The draftsman, depending on his experience and ability, is of two kinds. The heavy man is a designer and the lighter a detailer. In each group there are various levels. In different companies the levels and the titles will vary. Essentially they are the same thing.

In the detailer group, the production detail drawing of each part is made.

In the designer group, the layout drawings are prepared, and these will range from the conceptional (or sub-engineering) drawing, down to the fully detailed unit or sub-unit layout from which the information for making detail drawings can be taken. These men are variously called layout draftsmen or design draftsmen or junior engineers. The two latter are often synonymous.

All of these men are board men, all are creative in greater or lesser degree, and all contribute to the generation of the final design. The designer may, with the engineer, share responsibility for concept.

From this overall layout—which is the one that is submitted for conference approval—a series of other layouts can be prepared by the layout or design draftsman which will begin to incorporate such concrete elements as material, size, fastenings, critical tolerancing, and the separation of detail elements. These are production layouts and must contain sufficient engineering information to enable one or more detailers to prepare all the fully detailed drawings of each individual part.

In some, but not many companies, the entire function from design concept through layouts, and including all the details, is carried out by one man. This method lends itself to certain types of development work. It has the advantage of great flexibility in getting the drawings made, but is obviously much more expensive, since only top-level draftsmen are used.

The first form of drafting room

organization is the common one and enables the distribution of an appropriate level of assignment to an equal level of talent. It also provides the stepping stones on which the junior draftsman can climb to a senior status.

The junior draftsman or detailer will earn about five thousand dollars a year. The layout and design draftsman and the designer or junior engineer command a range between five and nine thousand dollars yearly.

Mostly these men are grouped into one large drawing room and operate under the supervision of a Chief Draftsman. This Chief Draftsman will often be a graduate engineer, as will a number of the designers. In some cases the draftsman functions as a part of a given project engineering unit and will live within the same immediate area as, and work directly with, the engineers.

Advancement Opportunities

There are few limits on advancement opportunities for the draftsman. In my own company, for instance, the following from-the-drawing-board promotions have been made.

Four men, who started with the company as layout draftsmen, are now Chief Draftsmen. Seventeen men, who started as layout draftsmen, are now full Designers. Of four men, who started as detailers, one is now a Personnel Manager, one is a Section Supervisor, one is a Fabrication Coordinator, and the fourth is a Planning Engineer. Of two men who started as layout draftsmen, one is a Cost Accounting Supervisor and the other is the Supervisor of Industrial Engineering. Two others, who started in the design draftsmen range, are now Project Engineers. The employment duration with our company for all of these men is from two to six years. This is commonplace throughout the industry.

Educational Opportunities

Educational opportunities are extensive. Most companies give a number of in-house courses free to their employees. Most companies will underwrite evening school education to an extent ranging from fifty to one hundred per cent of cost. A man, who improves himself by additional education, becomes more valuable to his employer, and consequently improves his advancement position.

Because both the challenge and the reward are there it follows that the opportunities would be given in the beginning mostly to such youngsters as appear to have the best qualifications for eventual success. The possession of drawing talent is not enough. Drafting is no longer a trade. It has become a sub-profession. An academic high-school diploma is felt to be minimum acceptable preparation. Emphasis on technical subjects, and mathematics in particular, is highly desirable. Post high-school and degree study are vigorously encouraged. The drawing room provides a golden opportunity for the achievement of professional and sub-professional status for those who forego formal day-college training. The potential, and the background, of the young draftsman must be good enough to meet the responsibilities which industry will offer him. If he hasn't got the training and potential, if all he can do is draw, he cannot last.

Drawing Practices

In the electronics industry, drawing practices are about the same as in most of the other industries. We use vellum paper. We use a limited number of pencil grades and, very rarely, ink. We use templates and other labor and time saving devices. We advocate, strongly, the readable drawing in preference to the beautiful drawing. We make changes — which means erasures—to our drawings with very great frequency, and require, therefore, a knowledge of erasing techniques; on vellum.

We look upon drafting as a communication device, as an integral phase of an overall engineering operation. We try to remember that it is only a phase and that it is not an objective unto itself. We try to hold our costs to a minimum, and our productivity to a maximum, and we tailor our operations to match up with and to benefit the rest of the engineering effort. We expect our draftsmen to live with, and to be a part of, this same philosophy.

Drafting Standards

To enable, and to encourage, the draftsman to perform his work in a reasonably consistent manner, a standards handbook is issued by virtually every major drawing room. This instrument serves not only to guide the draftsmen in the preparation of drawings; but also to assist the readers of these drawings in their interpretation. Since such standards are arranged specifically for a company use, their distribution is usually limited to employees of the company.

To provide nationwide standards as an overall guide to industry, two sources have been actively publishing overall drafting standards. One source, the American Standards Association, is sponsored by most of industry, and its standards are generally accepted and should someday supplant most of the individual company standards. The second source is the United States Government Printing Office which publishes military standards for Contractor use in the preparation of drawings against government orders.

Variations between the two standards are slight. It has been found that the government standards, as intermittent revisions occur, will generally follow the pattern set up by the American Standards Association.

American Standards are more elaborate, more detailed, and more illustrated. Also much more expensive.

MIL Standards are amply authoritative and illustrated, and cost considerably less.

Either of these sets of standards are of considerable value.

ASA Standards

Copies of these standards are available from the American Standards Association, 70 East 45th St., New York 17, N. Y., or from the American Society of Engineering Education, 29 West 39th St., New York 18, N. Y.

Size and Format, ASA Y14.1—1957 $1.00

Recommends standard sheet sizes and placing of title blocks, revision blocks, lists of material, drawing numbers, print folds and other format elements.

Line Conventions, Sectioning, Lettering, ASA Y14.2—1957. $1.50

Gives widths of lines, also when to use section lines, center lines, dimension lines and leaders, cutting-plane lines, break lines. In-

cludes principles to follow in use of sectional views.

Projections, ASA Y14.3–1957. $1.50

Pictorial Drawing, ASA Y14.4–1957. $1.50

Defines and illustrates various kinds of pictorial drawings used.

Dimensioning and Notes ASA Y14.5–1957. $2.00

Outlines rules, principles, and methods for specifying design requirements on mechanical engineering drawings by means of dimensions and notes. Appendix I explains true position dimensioning. Appendix II gives in detail the meaning of MMC, maximum material condition.

Screw Threads, ASA Y14.6–1957. $1.50

Government Standards

The government standards may be purchased from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., generally at a nominal cost. A partial listing of these documents is included below:

General Drawing Practice, The Author, JAN-STD-1	.30
Drawing Sizes, MIL-STD-2	.10
Format for Production Drawings MIL-STD-3	.20
Format for Construction Drawings MIL-STD-4	.15
Dimensioning and Tolerancing MIL-STD-8	.40
Screw Thread Conventions and Methods of Specifying MIL-STD-9	.20
Surface Roughness, Waviness, and Lay, MIL-STD-10	—
Abbreviations for Use on Drawings MIL-STD-12	.35
Electrical and Electronic Symbols MIL-STD-15	.45
Electrical and Electronic Reference Designations, MIL-STD-16	.15
Mechanical Symbols, MIL-STD-17	.30
Structural Symbols, MIL-STD-18	—
Welding Symbols, MIL-STD-19.	—
Welding Terms and Definitions MIL-STD-20	.60
Welded Joint Design MIL-STD-22	.40
Revision of Drawings MIL-STD-24	.10

The Author

John R. Carpenter is associated with the Ballistic Missile Division, Great Valley Laboratory, of Burroughs Corp., in Paoli, Pa. He was one of the founders and charter members of the Design-Drafting Council of Delaware Valley, and is currently involved in work on military drafting standards with the American Ordinance Association and other groups.

Editor's Note: The ASA Standards referred to in Mr. Carpenter's article, are still in preparation. They are sponsored jointly by the American Society of Engineering Education, the American Standards Association, and The American Society of Mechanical Engineers. When complete, ASA Standards will comprise a 17-Section American Drafting Standards Manual.

Sections available to date: 1 through 7, 9, 10, 11, and 17; these are each described briefly in Graphic Science for October 1959 (pp. 34 and 37). Still in preparation: Sections 8, 12, 13, 14, 15 and 16.

Changing Your Drafting Procedures?

Sample drawings present new requirements for drawing preparation more effectively than written instructions

by Clement F. Brown

All progress starts with change, hence, in a progressive company, the drafting supervisor may be faced frequently with the problem of instituting a new idea in drafting procedure, or an improved format in drawing preparation.

Many changes and innovations come on a "one-at-a-time" basis and the effect on the drafting department is not pronounced. However, new recruits – whether trainees or experienced designers–must be introduced to all procedures, methods, and standards during their break-in period.

The industrial consultant or the job-shop design company is faced with a more complex situation. Problems of the average drafting department are magnified because of work variety, a probable higher percentage of employee turnover and periodic changes of clients. These clients are usually "farming out" peak-load-period work. Most of them expect or insist their standards be adhered to by the design vendor; many supply standard - size drawing paper, forms, and a drafting standards manual for this very purpose. The manual is often a voluminous work that can be thoroughly digested only after a great deal of study. In fact, many of today's drafting manuals are so foreboding in size and scope that there is little incentive for the man on the board to delve into their contents.

Getting back to the problem of making changes in the drafting procedure, how can it be done with a minimum of effort and confusion? It has been said that "a picture is worth 10,000 words." Here, then is the direction in which to look for help during these changeover periods.

Sample drawings, such as the one shown opposite have proven highly successful in assisting the transition from one set of standards to a new one. Our illustration covers the principal points in preparing a drawing and bill of material for a weldment, with emphasis on the following: (1) drawing title-block entries; (2) bill of material (chronological listing of items); (3) drilling, tapping, and stud installation notes; (4) parts numbering and application; (5) weld symbol use; and (6) machine finish marks.

Since it is not within the scope of the sample drawing to indicate dimensioning methods, none are shown except plate thicknesses (for reference to the bill of material). Instruction notes can be set apart from the actual drawing by use of indicative style–such as color, handwriting, or typing. Circling these explanatory notes is another effective way to make them distinguishable from the drawing proper.

Other areas of work may require additional (and separate) drawings of explanation. These may cover specifically such items as castings, machining details, assembly drawings, and wiring diagrams, to mention a few. These drawings need not be of an actual part, assembly or arrangement to fulfill their illustrative purpose. Like the accompanying illustration, a purely hypothetical part or assembly often serves the purpose better. In fact, it is sometimes difficult to find an actual member that readily depicts all the points that should be covered in a single sample drawing.

This visual presentation method will be found most effective in "putting across" revised drawing requirements in the drafting room. However, some precautionary recommendations are in order regarding its adoption.

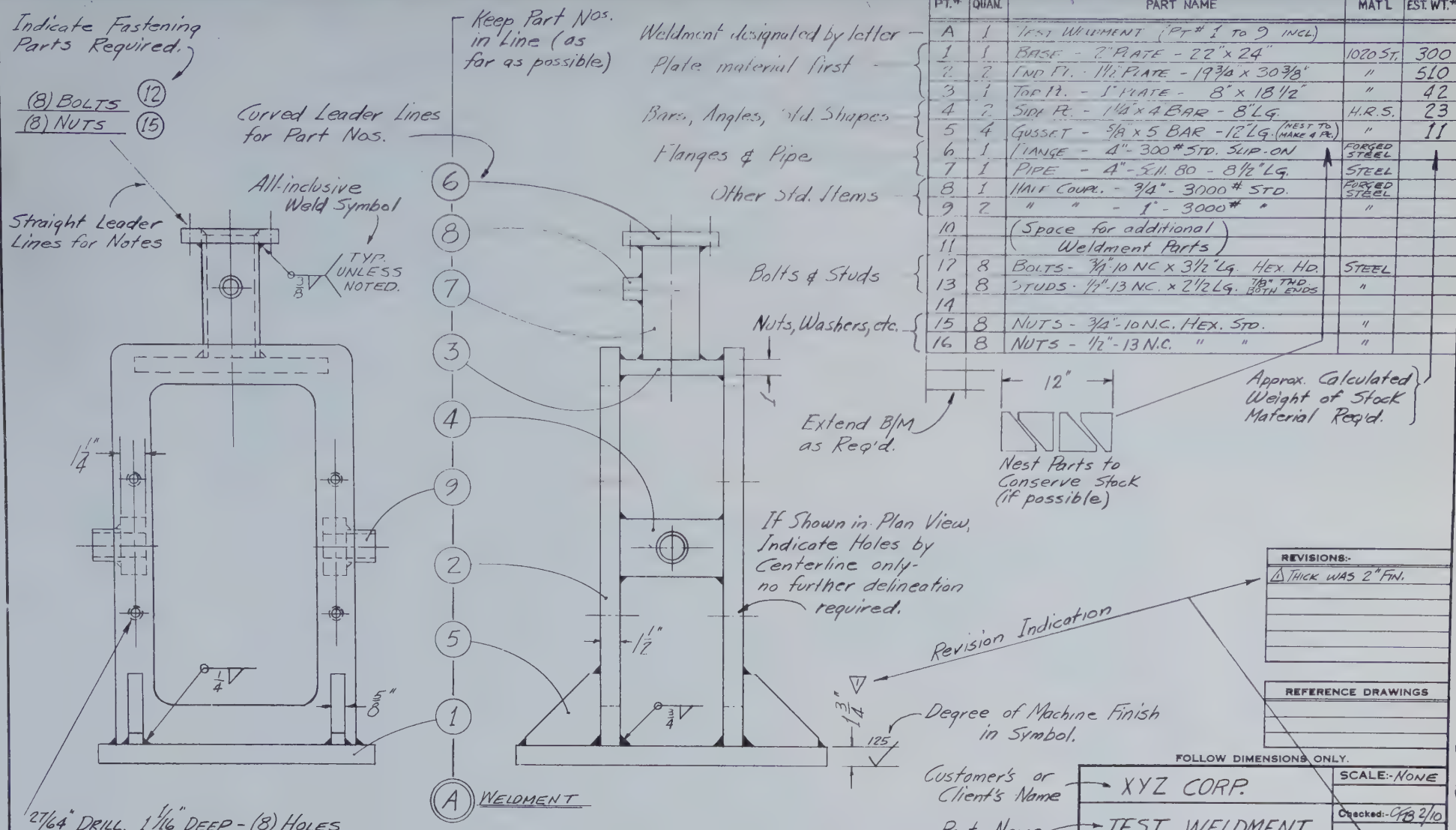
(1) Prepare sample drawings early in any new program–before the new work is started, if possible. Place the samples in the designer's and draftsmen's hands early, and the difficulty involved in changing incorrect and undesirable procedures will not present itself. A trouble-free start in any new system is an important factor in maintaining high morale.

(2) Make certain that the checkers fully understand the new procedures and requirements. Checkers are key men in this situation. If they understand clearly what is desired, and if they are consistent in their methods of checking, drafting deviations will soon disappear.

(3) Have whoever made the drawing make all changes and corrections. Some supervisors advocate the use of trainees to make drawing corrections as indicated by the checkers. This, however, is not advisable in many circumstances and certainly not at the start of a new program. The best way to correct misunderstandings or change bad work habits is to have each man rectify his own drawing errors. This sharpens the desire for personal improvement.

The Author

Clement F. Brown has a background of more than twenty years' experience in the fields of design (product, tool and design checking) and production (process, methods and industrial engineering). He is presently Production & Methods Engineer at Downingtown Iron Works, Inc., Downingtown, Pa.



PT.#	QUAN.	PART NAME	MAT'L	EST. WT.#
A	1	TEST WELDMENT (PT# 1 TO 9 INCL.)		
1	1	BASE - 2" PLATE - 22" x 24"	1020 ST.	300
2	2	END PL. - 1½ PLATE - 19 3/16 x 30 3/8"	"	510
3	1	TOP PL. - 1" PLATE - 8" x 18 1/2"	"	42
4	2	SIDE PL. - 1¼" x 4 BAR - 8" LG.	H.R.S.	23
5	4	GUSSET - 5/8 x 5 BAR - 12" LG. (NEST TO MAKE 4 PC.)	"	11
6	1	FLANGE - 4" - 300# STD. SLIP-ON	FORGED STEEL	
7	1	PIPE - 4" - SCH. 80 - 8½" LG.	STEEL	
8	1	HALF COUPL. - 3/4" - 3000# STD.	FORGED STEEL	
9	2	" " - 1" - 3000# "	"	
10		(Space for additional Weldment Parts)		
11				
12	8	BOLTS - 3/4"-10 NC x 3½" LG. HEX. HD.	STEEL	
13	8	STUDS - ½"-13 NC. x 2½ LG. 7/8" THD. BOTH ENDS	"	
14				
15	8	NUTS - 3/4"-10 N.C. HEX. STD.	"	
16	8	NUTS - ½"-13 N.C. " "	"	

REVISIONS:-
1 THICK WAS 2" FIN.

REFERENCE DRAWINGS

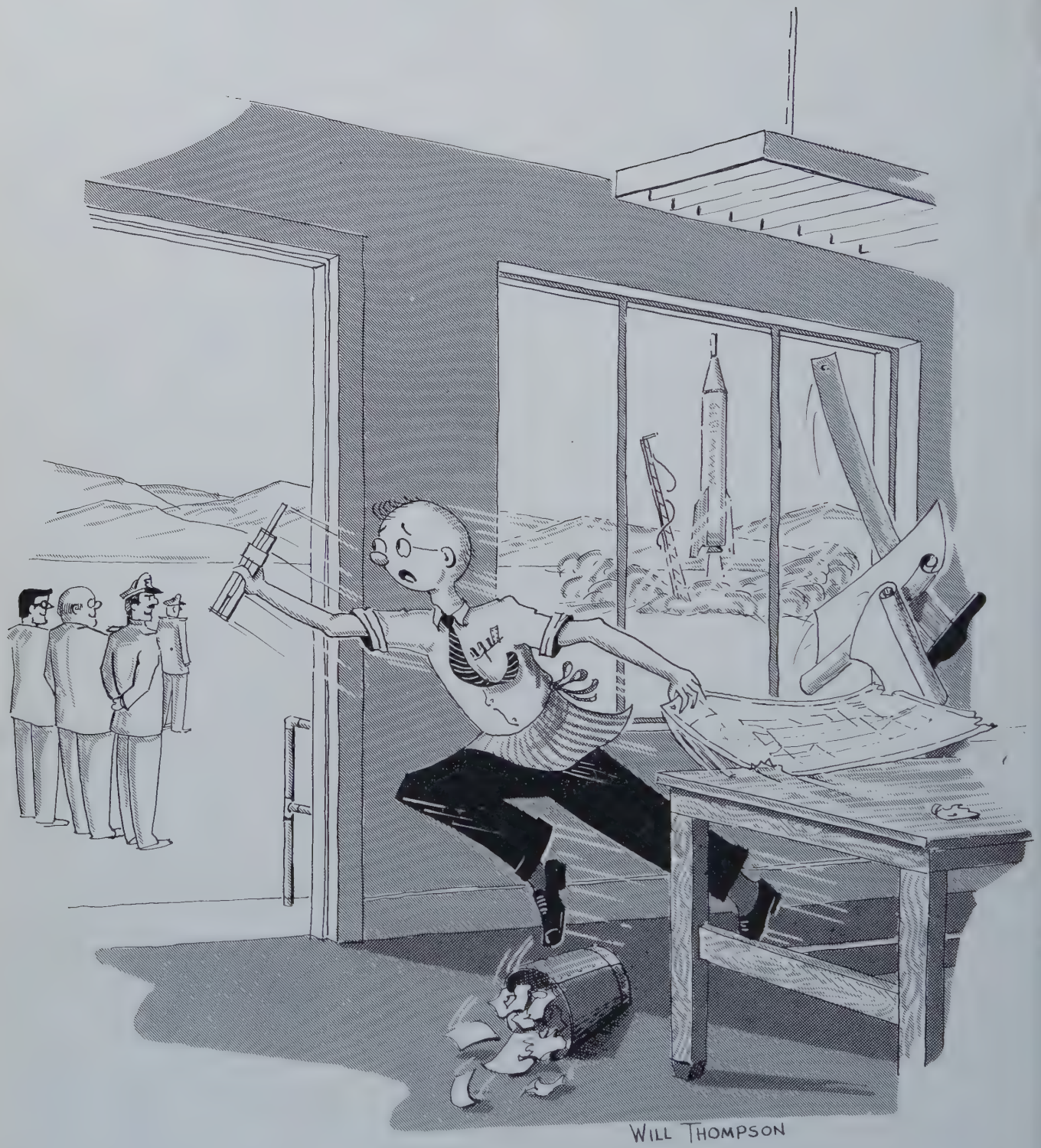
FOLLOW DIMENSIONS ONLY.

Customer's or Client's Name	XYZ CORP.		SCALE:-NONE
Part Name	TEST WELDMENT		Checked:-CHB 2/10
			Revised:-
			1 2/17/60 J.DOE
Drawn by:-	J. DOE	ORDER NO.	DRAWING NO.
DATE	2/8/60	01-1234	D-0001

from Engr. Job Folder

Sequence from Std. Book

DRAWING SAMPLE - WELDMENTS



"WAIT!!!"

CHANGES made on intermediate print particularize specific model of standard products; changed print becomes new master.

Clockmaker's Drawings

Sepia-line "intermediates" aid design variations of basic products

ONE OR MORE COPIES of 6,000 original drawings each month are required at Westclox Division of General Time Corporation, LaSalle, Peru, Illinois. A diversified product line includes wrist watches, pocket watches, electric clocks, key-wound clocks, and a recently introduced battery-operated radio timer.

The original drawings, or masters, may be on vellum, cloth or plastic. From these, diazotype sepia-line "intermediates" are made on translucent paper. This permits the sepia-line copies themselves to serve as masters for making additional copies. The term "intermediates" is used to distinguish them from the original masters.

According to William P. Beck, supervisor of engineering services, "Intermediates permit maximum flexibility at minimum cost. Suppose, for example, that the original drawing is of a basic product that may be produced in a number of versions. We make as many intermediates as we have different versions. Then each intermediate is modified as required. Since these intermediates are made on high-quality, 100-per-cent rag paper, erasures and additions can be made without damage."

DISTRIBUTION

DISTRIBUTION of copies made from intermediates varies, depending upon the purpose of the original drawing. For example, copies of proposed drawings are confined to industrial engineering, tool department, cost control, engineering, and sometimes the time-study department. From five to nine copies are sufficient for this distribution.

Trial-lot drawings made of parts not in production, or testing or developing for a limited run, are also copied using the diazotype process.

Released drawings, authorized for production and full

distribution throughout the factory and Westclox division, require up to 14 copies. In addition to the internal distribution, foreign distribution is required in the case of products to be manufactured in the firm's plants that are located in Canada, Scotland and Brazil.

"Sepia-line intermediates are particularly handy for foreign distribution," Mr. Beck said. "Our other plants can make all the copies of a drawing they need from intermediates received by mail. Since the originals of all drawings are retained in our files, along with at least one intermediate of every design change, loss of an intermediate through the mail does not present serious problems."

Why Diazotype Reproduction?

No newcomer to the field of diazotype reproduction, Westclox has for years used clear, black-on-white diazotype prints in place of blueprints.

"Before buying our present equipment," Mr. Beck said, "we compared our old copying machine with the available models of diazo machines. We found that the Bruning Model 500 Copyflex machine would run sepia-line intermediates just about as fast as regular prints. This was in marked contrast to the slow sepia-like reproduction speed of our former machine. Since we make thousands of intermediates every month, high speed is essential."

To produce a print, the translucent master is placed in contact with a sheet of translucent sensitized Copyflex paper. The two sheets are fed into the Copyflex machine, where they are held in close contact against a glass cylinder that revolves around a light source. The light rays deactivate the diazo coating on the sensitized paper wherever the light is not blocked by opaque markings on the original drawing.

After exposure to the light, the original drawing is returned to the operator, while the exposed sensitized Copyflex sheet passes through rolls that apply a thin film of developer. The developer converts the diazo coating remaining on the paper into a sharp sepia-line copy of the original drawing. The prints are dry, flat and easy to read.

OPERATOR feeds original and diazotype paper into Bruning Model 500 Copyflex machine at Westclox Div. of General Time.

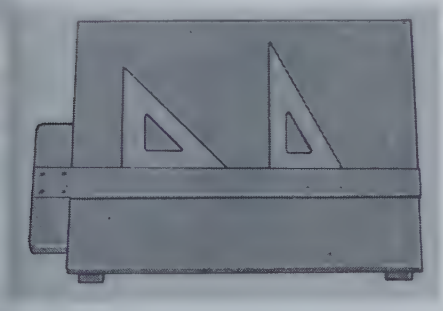
New Products

Lead Pointer

Designed for draftsmen, a "one-hand operation" lead pointer produces different lengths of clean, sharp points. Koh-I-Noor Pencil Co., Inc., of Bloomsbury, N. J., manufactures the unit, designated as No. 992. Graphite dust, stored in a plastic body below the turn-top, can be tidily removed. Each lead pointer is packed with three interchangeable nose pieces, desk or table clamp, and spare filters for wiping points. If clamped installation is not desired, a separate, heavy, metal base is available (No. 992B), which holds the lead pointer by friction.

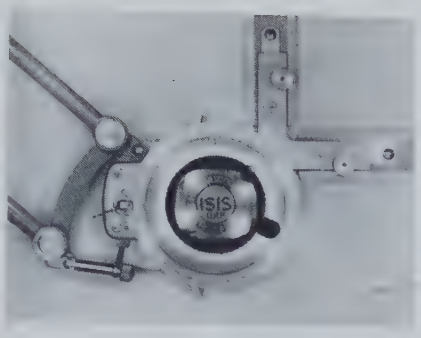
Tape Dispensers

All drafting and charting tapes, ranging in width from 1/64" to 2", will be packaged henceforward in Tape-Saver dispensers by Chart-Pak, Inc., Leeds, Mass. Tape protection and easier application are said to result. Sides of the Tape-Saver Dispenser can be snapped apart to remove tape



Drawing Kits

Portable equipment for technical drawing, layout work, or for sketching, is offered by Alvin & Company, Inc., 611 Palisado Ave., Windsor, Conn. Each kit consists of Basswood drawing board, Maple T-square and two transparent triangles. A built-in device on the back of the board holds T-square and triangles when they are not being used. Kits are available in four sizes: 10 by 12 inches, 13 by 19 inches, 17 by 22 inches and 19 by 25 inches.



Drafting Machine

A drafting machine head with adjustable base lines has been developed for making drawings in which the axes are not in line in the usual horizontal and vertical positions. Manufactured by Schmidt & Haensch in West Germany, these Isis Universal Drafting Head Machines are distributed in the U. S. by Isis Incorporated, Box 1062, York, Penna. Two movable angle stops may be set for positioning of the scales to pre-determined reference angles or base lines. The Isis Universal Drafting Head also allows rotation and indexing of the scales about the full 360° range, independent of any base line. These machines are available for use on either vertical or horizontal boards.

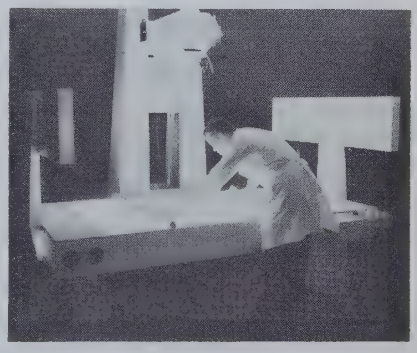
Desk-Top Copy Makers

Same-size copies of diagrams, drawings, sketches, reports, or charts on any translucent original can be made through the semi-moist diazo process on Dart Copy Makers. Manufactured by Copymation, Inc. (formerly Peck & Harvey Mfg. Corp.), Chicago 45, the machines are semi-automatic in operation. Both 13- and 18-inch models of the Dart are equipped with 800-watt lamps. Both models also include a second lamp (and circuit) for exposing standard photocopy papers. Thus, with an accessory processor, the Dart permits photocopying of opaque materials or two-sided originals onto paper or onto translucent secondary originals.

(For additional information regarding the new products described here, contact the manufacturer directly. Complete addresses are included.)

Positive Reproduction Paper

Silver-sensitized reproduction paper for making enlarged positive copies directly from negative microfilm has been developed by Anken Film Co., subsidiary of Anken Chemical & Film Corp., Newton, N. J. According to the manufacturer, this process has been developed to eliminate the three-tray manual developing operation when making enlargements of mircofilmed drawings, maps, etc. With Projection Mono-Copy, the operator exposes in the normal manner on any standard microfilm reader-printer or microfilm projection equipment. One-step developing is done in Anken's Monobath solution (a combination developer and stabilizer), using a machine processor of the Anken "27" type.



105/35mm Camera-Projector

The first camera-projector capable of utilizing both 105mm and 35mm film in its operation is now available from Keuffel & Esser Co., Third and Adams Sts., Hoboken, N. J. Called the Micro - Master 105/35mm Camera-Projector, the unit requires no more space than existing cameras alone. The camera-projector is completely motorized. This includes a motor-driven projector magazine which changes negatives automatically, and a motorized filter built into the optical system. According to the manufacturer, it provides the highest production rate in the field, with first-quality negatives and blow-backs of originals. It is said to be the first planetary camera with a subject area (44 by 64 inches) which fully covers 42-inch tracings. It is also the first projector which holds 35mm roll film under vacuum during exposure.

New Literature

Photography Serves Engineering, a brochure (Form No. A-6114-1), outlines three major applications of photography in engineering design. It may be requested from E. I. du Pont de Nemours & Co., Inc., Photo Products Dept., Wilmington 98, Del. The brochure discusses the uses of Cronaflex—Du Pont's line of engineering reproduction materials on Cronar polyester photographic film base—for photo tracings, model photography, and as a plant modification tool.

Microfilm Reader Specifications (Form No. R-1) covering the Model "U" Universal Reader, is offered by Documat Inc., 384 Concord Ave., Belmont, Mass. Designed principally for use with the Documat 34.5x Model PFA Camera, the Reader permits viewing of either 16mm or 35mm film.

Drawing Instruments Booklet, *Historical Note on Drawing Instruments,* may be requested from V. & E. Manufacturing Co., 758-766 S. Fair Oaks Ave., Pasadena, Calif. Published first in 1950, this scholarly booklet traces the development of drawing instruments and drawing methods from the Roman Period down to the present. There are some fascinating illustrations of early instruments, including a drawing by Leonardo da Vinci dating from the 1400's and a photograph of George Washington's drawing instruments, now reposing in the Museum at Mount Vernon.

Exhibition and Display, a 190 page book by James Gardner and Caroline Heller, has been published by F. W. Dodge Corp., 119 West 40th St., New York 18, N. Y. Of interest to architects and others who plan or use exhibitions to show goods and services, the volume presents a wealth of graphic information. Price: $13.75.

Recruiting and Training Draftsmen by L. E. Tepper, a reprint from *Graphic Science* magazine, has been published by Kinelow Publishing Co., Inc., 103 Park Ave., New York 17, N. Y. Copies are available for distribution at cost of postage.

Drafting Equipment Pamphlet (No. J.6), describing drafting machines for vertical boards, may be requested from Isis Incorporated, Box 1062, York, Penna. Specifications of the Isis Drafting Table are also included. Isis Incorporated is the U. S. distributor for these Schmidt & Haensch products manufactured in West Germany.

Photocopying Products Catalog, listing and describing over 50 diffusion transfer photocopying products, has been prepared by Ampto, Inc., Newton, N. J., a subsidiary of Anken Chemical & Film Corporation. Photocopying machines and transfer processors, transfer papers and films, photocopy chemicals, and a varied line of accessories are covered in the catalog,

File Cabinet Brochure, titled *Design Your Own Files with Record-Stack* describes a variety of standardized, mass-produced components which can be intermembered for flexibility. The illustrated brochure (Form No. SC 818A) may be requested from Remington Rand, Div. Sperry Rand Corp., 315 Park Avenue South, New York 10, N. Y.

Transparencies for Overhead Projection, pamphlet No. S-7, 1-58, may be requested from Eastman Kodak Co., Sales Service Div., Rochester 4, N. Y. The pamphlet describes several simple photographic procedures by which transparencies can be prepared for use in overhead projectors. Original subject matter can be linework, such as charts and graphs, or continuous-tone photographs, and can be either translucent or opaque.

Digital Computers and their uses in small business is the subject of Management Aids for Small Manufacturers, No. 109, dated November 1959. Aid 109 is available free from field offices and from the Washington headquarters of The Small Business Administration, Washington 25, D. C.

Drafting Tools Booklet (No. 17188), entitled *So You're Going to Be an Engineer,* presents drawing instruments, drafting machines, drafting media, scales, and miscellaneous drafting tools marketed by Keuffel & Esser Co., Hoboken, N. J. Written and illustrated by Don Herold in semi-humorous vein, the booklet is offered without obligation by K&E. Reference material in tabular form, such as Units of Measurement with Conversion Factors, is included.

Micro-Frame Developer Brochure, describing a compact Kalfax unit that permits selective printing and developing of micro-images to the same Kalva-Kard weeks or months later, may be requested from Kalvar Corp., 909 S. Broad St., New Orleans 25, La. The Kalfax Process (see GRAPHIC SCIENCE, p. 13, February 1960) is a basically new system of photography which does not require chemical processing or darkroom techniques.

(Copies of the literature reviewed can be obtained directly from the manufacturer or publisher. Complete addresses are included.)

The Book Shelf

by Jay H. Bergen

TRUE POSITION DIMENSIONING, by D. Bibeau and D. Sweet., 28 pages, 8½ by 11 inches, well illustrated. Available from Publications Department, Scintilla Division, Bendix Aviation Corp., Sidney, New York. (one to 10 copies, $3.00 each; 10 or more, $2.50 each)

This book contains much of value to standards engineers, designers, draftsmen, drafting supervisors, and others who may specify or interpret drawings.

The terms "Maximum Material Conditions" (MMC) and "True Position" (TP) are fairly new and, to some extent, misunderstood by many. This book goes through a step-by-step explanation of these tolerancing methods and principles in a manner that will hold the reader's interest from cover to cover. These terms, and the many other associate terms, are defined and explained thoroughly.

The book is arranged in such a manner that it takes the reader through the basic steps and then into the meat of "True Position Dimensions." The illustrations used are very well prepared and contain the right amount of information to make them easily understood. The comments that attend each illustration are clear, concise and should be easily understood even by those who have only a smattering of knowledge of engineering drafting practices or blueprint reading.

Because of rising manufacturing costs, many engineers and engineering groups are spending a great deal of time investigating various methods of dimensioning and their meanings as far as manufacturing processes are concerned. With all other things equal, "True Position Dimensioning" will tend to increase allowable tolerances and thus decrease costs. While this method may increase the cost of inspection in some cases, these costs will be more than absorbed by a definite increase in acceptable parts.

Changing shop practices so that all operations are performed to "Maximum Material Conditions" will also result in sharp decrease in scrap with its resultant savings. Simply stated, MMC will allow sufficient material for reworking of the major portion of parts that do not receive immediate approval of the inspector.

Those who are trying to initiate these methods within their organization will find that this book will be a valuable aid in explaining their thoughts to management and a must for explaining these methods to shop employees.

"Drink Deep – – –"

IN THIS COLUMN several months ago I described the newly-formed Design-Drafting Council of Delaware Valley. Several other organizations are also active in the education of drafting supervisors and teachers.

THE Massachusetts Technical Drawing Teachers Association has just been organized. An outgrowth of a Mechanical Drawing Teachers Conference last year, this group is holding its first meeting May 18 at Northeastern University in Boston. Theme: The Pre-College Technical Drawing Curriculum. High school drawing teachers and administrators from the entire state will be invited to attend. For others interested, more information can be obtained from Carl A. Olson, Jr., Secretary, MTDTA, Wellesley High School, Rice Street, Wellesley Hills, Mass.

The program, beginning at 8:30 a.m., includes a talk by Ashley S. Campbell, Dean of the School of Engineering, Tufts University. A curriculum Committee, which has been working on a "standardized" high school drawing curriculum for college-prep students, will present its report, and exhibits by drafting equipment suppliers and text book publishers will be on hand.

IN THE SERIES OF ARTICLES begun in December and just concluded in the April issue, "Operations and Procedures for Engineering and Drafting Supervisors" by George C. Schmidt, Chief Draftsman, Campbell Soup Company, mention was made of Industrial Education Institutes, to whose operations we were introduced by Frederick Bright, one of Industrial Education Institute's executives.

IEI sponsors three or four seminars of interest to men responsible for drafting operations. Among them are a one-day seminar on "Reducing Costs with True Position Dimensioning and Tolerancing" (lecturers are Donald H. Reed, and Daniel Ribeau, Scintilla Division, Bendix Aviation, whose book on this subject is reviewed on page 33, this issue), and a seminar on "Reducing Costs in Drafting and Design Operations." Lecturer here is Don Fuller, Director of IEI's Drafting and Design Divison.

The Institutes sponsor seminars on these topics periodically in major cities throughout the country, and on occasion, within one firm. Details regarding coming programs can be obtained from Walter J. Cahners, President IEI, 25 Huntington Ave., Boston 16, Mass.

For those planning an European vacation, IEI also sponsors seminars in Milan, Rome, Madrid, London, Paris, and Stockholm.

Costs for attending the seminars is usually about $50.00 for one day per man, with special rates sometimes provided when a company sends a team.

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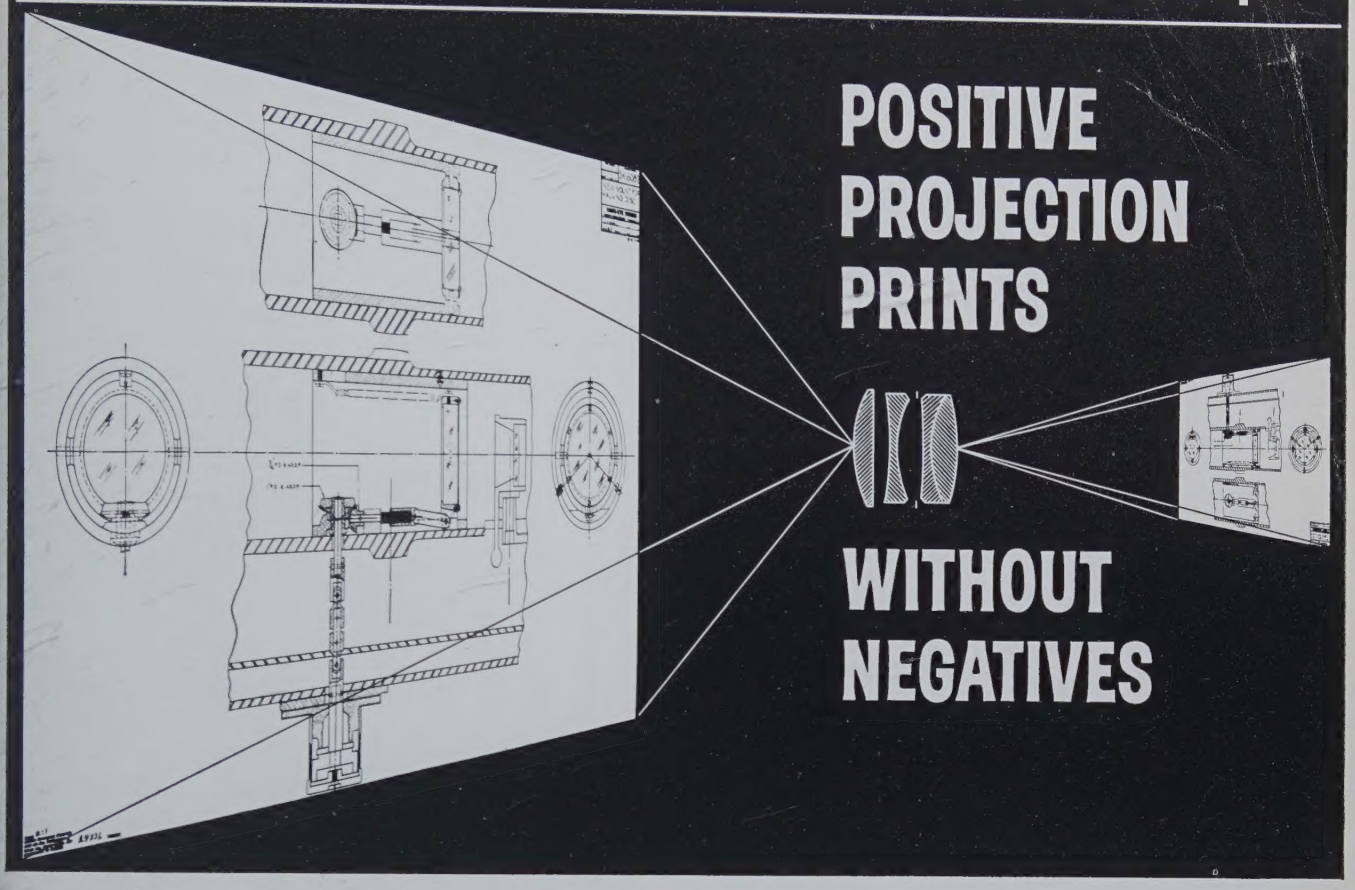

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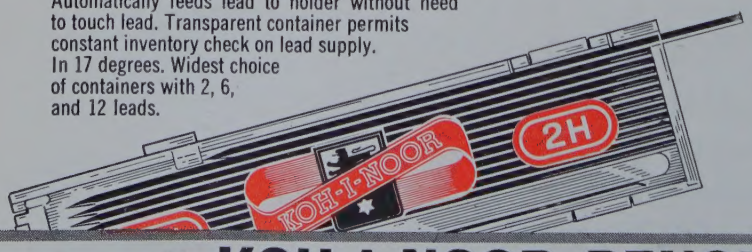

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